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	Page
Railway Train Lighting	481
The British Association	482
Sane and Sound Tramway Policy	482
Gas Propaganda in Germany	482
Competition in Buenos Ayres	482
The Monopoly Question in Germany	483
Southport Electricity Supply	488
Notes from Canada	483
The British Association.—IV :—	
The Féry Bomb Calorimeter (*illus.*)	484
The Scientific Theory and Outstanding Problems of Wireless Telegraphy (discussion) (*concluded*)	484
On the Importance of Previous Magnetic History to the Engineer (*illus.*)	487
Correspondence :—	
The Prevention of Corruption	487
Industrial Engineering	487
Switchboard Fires	488
The Textile Institute	488
Legal	488
Electrical Exhibition in Bahia Blanca (*illus.*)	489
New Electrical Devices, Fittings and Plant (*illus.*)	489
Business Notes	491
Notes	498
Electric Winding Plant at Kippax (*illus.*)	499
Coal-Handling Plant at the Wigan Electricity Works (*illus.*)	501
The Municipal Tramways Conference	503
Fuel for Diesel Engine	504
City Notes	507
Stocks and Shares	509
Market Quotations	510
Share List of Electrical Companies	511
Exports and Imports of Electrical Goods during August, 1912	513
The Use of Mica in the Insulation of Electrical Apparatus (*concluded*)	514
Important Cases in the Legal Year	515
North-Eastern Counties Electrical Exhibition	516
Indian Notes	517
High-Frequency Discharges in High-Tension Transformers (*illus.*)	518
Deterioration of Stored Coal	519
New Patents Applied For, 1912	520
Abstracts of Published Specifications	520
Contractors' Column Advertisement pages xxiv, xxvi and xxviii	

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RAILWAY TRAIN LIGHTING.

THE shocking accident which took place at Ditton Junction last week, when a number of unfortunate passengers, imprisoned in the wreckage of the telescoped coaches, were not merely killed, but tortured to death by fire, once more draws attention to the frightful dangers entailed by the use of gas for lighting and cooking on railway trains. It is not as if there were no alternative; the remedy lies ready to hand. Electricity is perfectly capable of performing all the functions now fulfilled by gas, with the exception that it cannot be accused of roasting the passengers, and the preference still exhibited by some of the railway companies for the older system is attributable only to a tender regard for the pockets of the shareholders, arising from the belief that a slight economy can be effected by its use. Whether even the last-named advantage is realised is highly questionable, as evidenced by the fact that some companies have adopted electric lighting on a considerable scale, and are extending its employment; but even if it could be demonstrated that gas was the cheaper, the fact would not have any material bearing on the question, for the safety of the passengers ought to be the first and paramount consideration.

The Board of Trade inquiry has not yet been held, and it may be urged that there is no proof of the accusation levelled against gas; but it is admitted that five of the coaches were lighted by gas, and two by electricity; the latter were not burnt, but two of the former were, and the conflagration is ascribed by the railway Press either to gas or to hot coals from the locomotive. We have on a previous occasion pointed out that it is practically impossible for burning coals to escape from the firebox of a locomotive in a head-on collision; red-hot ashes might be projected forwards from the ash-pan, but are we to believe that they were sufficient in quantity, and sufficiently distributed, to cause the immediate ignition of two coaches and their rapid destruction? Moreover, in this case, the locomotive ran against a bridge and the coaches ran past the bridge and piled up at the platform. On the other hand, even if the gas tanks remain intact, the gas pipes are practically certain to be broken in a collision, and a torrent of gas is thus released, providing ideal conditions for the disastrous holocausts with which we are so cruelly familiar. To argue that the gas was not to blame is to fly in the face of reason.

Twelve of the 17 victims who lost their lives were burnt. Had it not been for the fire, which prevented their rescue, it cannot be doubted that some at least of these would have been saved; and even if the railway directors regarded the matter only from the sordid standpoint of pounds, shillings and pence, would not their outlay on compensation have gone far towards covering the difference in cost?

For many years past the Inspectors of the Board of Trade have consistently urged the desirability of substituting electricity for gas, and have on various occasions definitely attributed fires to the use of gas. But nothing further is done, and the railway companies ignore the recommendations which are not backed up with compulsion. The public sleepily looks on, and the lay Press roundly abuses the companies for three days—then all is quiet until the next horrible disaster.

Our contemporary, the *Gas World*, dolefully says, "One felt sure it would happen"—namely, that the fire would be attributed to the use of gas—and proceeds to abuse the daily papers which pointed out the wickedness of persisting in

that dangerous practice. Curiously enough, the day before this lament appeared, an explosion in an office, which resulted in the death of a passer-by and burns to a clerk, was also ascribed to escaping gas, owing to the singular coincidence that just before the explosion a clerk had been investigating the source of an unpleasant "gassy" odour with the aid of a lighted match. One cannot but regret that indiscreet and sensational journalists should thus hastily jump to conclusions so obviously unwarranted by the facts and cast aspersions upon an innocent illuminant. Clearly, the explosion must have been due to hot coals.

The British Association.

The meeting of the British Association at Dundee has been a memorable one for several reasons. At the concluding meeting, in passing votes of thanks to those who had contributed to the exceptional success of the event, the President, Prof. Schäfer, said with truth that the Association had never met with more generous hospitality or a warmer welcome. The number of visitors exceeded all expectations, and the usual social entertainments were carried out on a most lavish scale, concluding with a ball, to which practically the whole Association was invited. The serious side of the work was also better supported locally than for years past. The greatest credit was due to the organisers who were responsible for the arrangements; with numbers swelling to the last moment until a grand total of over 2,500 Members and Associates was reached, it will be well understood that their task was heavy.

The meetings of the Sections were well supported throughout, and there were present many of the foremost men in the various branches of science; there was, perhaps, less of the sensational and spectacular than usual, and a much closer attention to serious work. Each of the Sections was presided over by a man of the very first rank, and it seemed that the papers had been selected with more than the usual care. The evening discourses and popular lectures were most successful, and the attendance proved that the interest taken by the people of Dundee was genuine and intelligent. There was a feeling of sincerity throughout the meeting to which the local Press, by its surprisingly able and critical reports, greatly contributed.

In one matter alone were the arrangements open to criticism, and that was in the very small numbers invited to inspect the industries of Dundee. This may be due to the fact that the jute industry is very highly specialised, and if the manufacturers were not ready to throw open their establishments to considerable numbers of visitors, it is hardly surprising; though it was certainly disappointing to many of the visitors. It remained to a jute manufacturer, however, to put the coping stone on the vast edifice of satisfaction built up for the British Association in the unprecedented gift of £10,000 given unconditionally to the Association by Dr. J. K. Caird. It was stated, whether correctly or not we do not know, that the largest previous gift to the Association in its whole history was £30. That this magnificent sum will be properly applied to produce the greatest possible advancement of science may be taken for granted, and we hope the first result will be to make the task of Prof. Perry, the general treasurer, in dealing with applications from the Sections for grants in aid of original research a little less difficult.

The British Association does not in these days, as a rule, get the first announcement of notable discoveries in any branch. These go first to the special societies. But it records year by year the general advance of knowledge, and diffuses it abroad. And one great advantage that it possesses above all the other institutions is that it brings together all the branches of science, and not only promotes useful and fruitful friendships between men working in fields remote from each other, but it is every year obtaining good results from joint discussions between the Sections. A notable instance of this was the very valuable combined debate between Sections G (Engineering) and A (Mathematics and Physics), on wireless telegraphy, which we have reported fully.

Another quite unique feature of the British Association is the large attendance of foreign experts from all parts of the world. No other institution attracts such a number of foreign scientific men.

The British Association meets next year under the Presidency of a distinguished engineer, Sir Wm. White, at Birmingham, on September 10th, but we have no hesitation in saying that even the Midland Metropolis will find it difficult to surpass the success of the Dundee meeting. In the following year, 1914, the meeting is to be in Australia, and Mr. Fisher, the Prime Minister of the Commonwealth, recently stated that about 50 per cent. more members are now expected than was at first thought possible. Lavish arrangements are being made for an extended tour throughout Australia.

There is also an invitation under consideration at the present time for those members who do not go on the Australian trip to attend a meeting of the French Society for the Advancement of Science, in 1914, at The Havre, and thus make it a joint meeting or "Entente Cordiale" of science. Considering the vast debt which science owes to the French nation, this invitation should not be refused, unless there exists some absolutely insurmountable difficulty.

Sane and Sound Tramway Policy.

In his presidential address to the Municipal Tramway Association Convention which comes to a close to-day, Mr. Blain makes the following remarks on sound business management:—

"Grants in aid of rates should be unknown until the undertakings have such adequate reserve funds as shall build their position on the solid rock. Election pressure for unripe extensions, undue fare concessions, or unreasonable labour conditions, should be resisted without fear of personal consequences, and I have never yet known an electorate which failed to appreciate a straightforward statement of honest, business-like policy, laid before it by an honest, straightforward and business-like representative."

Wise words of counsel these. The strong and sound policy here outlined in so few words, if followed, may save some of our tramway undertakings from getting into the deplorable condition in which too many electricity supply systems have fallen, because they have neglected the warnings and advice respecting financial soundness, reserves and depreciation, business management, and so forth, that have been so continuously given to them in our own pages and in other quarters.

Gas Propaganda in Germany.

Some time ago, an Association was formed in Germany to promote the consumption of gas; from a note in the *Gas World*, it appears that the results have been highly satisfactory, for "The German Gas Promotion Centre says the effect of the gas propaganda has been remarkable; the attitude of the public mind seems to have quite changed, and the manufacturers are very busy, their orders having in some branches increased as much as sixfold." The Centre also remarks that "a thoroughly good canvasser is a most valuable member of the staff of the gasworks, but he is not to be met with every day"; he ought to be specially trained, and the Centre is taking steps to carry out such training. The experience of the Gas Promotion Centre is directly applicable to the supply of electricity also, and we commend this example of successful collective effort and enterprise to the notice of British central station managers.

Competition in Buenos Ayres.

It was reported a short time ago that an Italian-Argentine company was in negotiation with the Buenos Ayres municipal authorities with a view to obtaining a concession for the supply of light and power in that city. As the largest supply undertaking in the Argentine capital, although not possessing an absolute monopoly, the German Transmarine Electricity Co. became somewhat disturbed at the prospect of possible competition, and addressed a memorial to the city authorities on the subject. It was pointed out that the company's charges for light and power in 1915, when the

contemplated rival would be able to start a supply, would be actually lower than the prices proposed by the Italo-Argentina company, and it was therefore submitted that no commercial basis existed for the authorisation of the latter. Before sufficient time had elapsed for the consideration of the memorial, a fresh rival appeared in the form of the existing Lacroze Tramways Co., which has suddenly discovered a clause in its concession which permits the company to furnish energy for lighting and industrial purposes both in the city and the province of Buenos Ayres. At present the tramway company supplies power for the operation of its tramways, and is engaged in extending its works so as to be able to deal with the concession which the company obtained a year ago for the construction of underground railways in Buenos Ayres. The company has secured the authority of the National Government to carry into effect the hitherto unexercised clause for supply for public and private purposes, and it only remains for it to arrange with the municipal authorities in regard to the laying of cables, but the Government stipulates that the conditions are not to hinder the working of the clause in question.

The Monopoly Question in Germany.

The Aix-la-Chapelle Chamber of Commerce raises this question in its annual report from two points of view. In the first place, it is stated that notwithstanding the efforts put forward by the special electrical firms and the Union of Installation Firms to combat the monopolistic endeavours of the large firms in installation work and the supply of materials for the construction of overland central stations, it is only with difficulty that conditions can be inserted in the agreements so as to exclude a hidden monopoly from the holders of the concessions. A desperate fight is proceeding in the electrical market between the special works and independent installation contractors on the one hand, and the large firms on the other, and this will finally be decided in favour of the latter unless the Government adopts energetic measures for the protection of the smaller establishments. The second problem, to which attention is probably directed for the first time, refers to the acquisition of leases of electric supply works. The report submits that offers to take over municipal or communal electricity works have been made by the large firms in recent times in the most varied localities, and it is contended that if these firms are able to secure a lease of these neutral supply works, their strength will become so great as to cause the German industry to mature into the American trust system.

Southport Electricity Supply.

Far be it from us to rejoice over the troubles of our friends; much rather would we rejoice with them in their prosperity. But when we see an undertaking in such a plight as that of the Southport electricity estate, we cannot refrain from lamenting that the Electricity Committee, ignoring our friendly advice, and seeking only a fleeting popularity, applied large sums of money to the so-called "relief of the rates," instead of first building up a substantial reserve and depreciation fund to provide against those eventualities, which, as we have continually pointed out, sooner or later were bound to arise.

Now, the crisis has arrived; the sins of the municipality have found it out, and, according to the report of Mr. S. J. Watson, of Bury Electricity Works, who was appointed by the Southport Corporation to investigate the matter, the ratepayers are liable for about £20,000 for depreciation in the value of the assets of the Electricity Department. During the 14 years' existence of the undertaking no reserve fund has been formed, although the undertaking has been robbed of £27,000 in aid of rates.

It is one of the chief drawbacks to the municipal control of such an enterprise, that all questions of management are liable to be subordinated to party politics by time-serving politicians, and the true interests of the business are sacrificed to the desire to catch votes. Unfortunately, too, the punishment, when at last it falls, rarely alights upon the true culprits, though those who take up the reins and allow so rotten a policy to continue are, no doubt, as blameworthy as the original sinners.

We cordially endorse the views expressed by Mr. Watson, and agree with him that depreciation should be provided for each year without fail, even if the doing so involves a contribution *from* the rates. We have consistently maintained this principle for very many years, and have suffered much abuse in consequence thereof; but it is now generally recognised that the policy we advocate is sound and in the best interests of electricity supply undertakings, and we trust that those who still hold out against it will take speedy warning from such cases as that of Southport—which, by the way, does not stand alone.

NOTES FROM CANADA.

[from our special correspondent.]

In the Province of Saskatchewan the towns of Humbolt and Canora have recently decided to spend £6,000 and £4,000 respectively in establishing electric lighting plants, while in Regina it is proposed to spend some £120,000 on improvements to the municipal tramway system.

The Western Canada Power Co., it is reported, has secured a contract for the supply of 40,000 h.p. to the British Columbia Electric Railway Co., and probably extensions to the plant of the former company will be required.

It is reported in the daily papers that owing to the immense amount of water power available, it is not improbable that at some future time the motive power for the Hudson Bay Railway will be electricity. Tenders for the construction of the last section of this line, viz., that reaching to the seaboard, are already in the hands of the Government. A more extended plan for the utilisation of the water-powers mentioned above is also proposed. This is to supply power to the Western Provinces in very much the same manner as is being done in Ontario by the Hydro-Electric Power Commission.

The Ontario Commission just referred to has recently been devoting a good deal of time and energy to educating farmers in the many ways in which electricity may be of service to them.

The Chairman (the Hon. Adam Beck) is very enthusiastic in this matter, and is of the opinion that the use of electricity on the farm will go far to solve the labour problem, which, out here, is a serious one, owing to the difficulty of obtaining help and the consequent high wages. A special motor-wagon has been equipped by the Commission recently, and by its means, on a number of farms, a practical demonstration of what electricity can do for the farmer has been given. Threshing, pumping, ironing, cooking and heating have all been demonstrated, and a good deal of interest has been aroused in agricultural circles. In addition to this, the Canadian National Exhibition, a few particulars of which appeared in these notes some time ago, afforded an opportunity for an exhibit of various electrically-operated farming and domestic appliances.

It is probable that this effort on the part of the Commission will be watched by many communities outside of Ontario with great interest, and, if it turns out successfully, will be copied in many places.

News from Ottawa states that a claim has been filed against the Hydro-Electric Power Commission for about £600,000 for damages arising out of the expropriation of the Chats Falls property. The cost of this property to the owners was about £400 a few years ago. The Commission intends to utilise the falls for power purposes; according to the Conservation Commission, there is a possible development at this point on the Ottawa River of 58,000 h.p., and with regulated water and a canalised river, of 150,000 h.p. The available head is 48 ft.

D

THE BRITISH ASSOCIATION.—IV.

The Féry Bomb Calorimeter.

By ROBERT S. WHIPPLE, M.I.E.E.

(Section G. Abstract.)

THE instrument which I bring to your notice is one designed by Prof. C. Féry, of the Ecole Municipale de Physique et de Chimie, Paris. It is not dissimilar to the well-known Mahler calorimeter, with the exception that the bomb is much lighter and there is no water jacket. Fig. 2 shows the construction of the instrument. The bomb A, in which combustion takes place, is a cast-iron vessel weighing about 1 kg. and having a capacity of about 250 cb. cm. It is supported by two constantan disks, K and K, about 1 mm. in thickness, the disks being soldered both to the bomb and to the brass

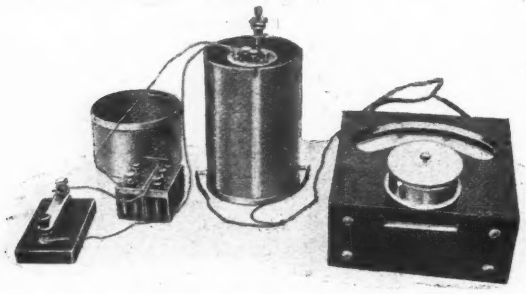


FIG. 1.

surrounding vessel B. The cover of the bomb is held in position by means of the collar (shown in section), which fits over the top of the bomb in a somewhat similar manner to that in which a breech fits a modern gun. The coal to be tested is placed on the small tray C, and is ignited by means of a piece of cotton resting on the nickel-chromium heating wire connecting the two terminals in the cover, the latter being connected to the battery P. Oxygen at 200-lb. pressure is introduced into the bomb through the needle-valve *p*.

Thermo-couples made of constantan (an alloy of copper and nickel) and iron are largely employed commercially, giving an E.M.F. of about 40 micro-volts per degree Centigrade. In this instrument the constantan disks and the bomb act as a thermo-couple, the iron of the bomb forming the hot junction, the brass surrounding vessel the cold one. The E.M.F. thus generated is measured by the voltmeter V.

In the Mahler calorimeter the weight of the bomb is about 3·5 kg. and the weight of the water is about 2·5 kg.; in the Féry instrument the weight of the bomb is only 1 kg. and there is no water, so that its water equivalent is in comparison very small. As a result, the temperature rise due to the combustion of 0·5 gramme of coal is 20° C., as compared with 2° C. in the older

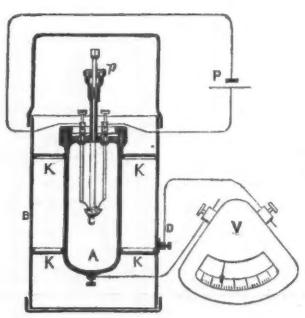


FIG. 2.

instrument. The pointer galvanometer employed gives approximately a deflection of 60 mm. for 800 microvolts (20° C.), so that it is possible to estimate the temperature rise to within 0·2° C., or to $\frac{1}{300}$ of the total rise in the temperature of the bomb. The simplicity of this method of reading the temperature as compared with the difficulty of reading finely divided mercury thermometers will be appreciated by all who have worked with the latter.

The loss of heat from the bomb is due to three causes :—

1. Conduction along the constantan disks.
2. Convection by the air currents in the space surrounding the bomb; and
3. Radiation from the walls of the bomb to the surrounding shell.

Considering the first cause—conduction would simply tend to lower the temperature to which the bomb would rise if the supporting disks were non-conductors. The rate of loss of heat by conduction may be assumed to be proportional to the difference in temperature between the centre and circumference of the disks.

Convection currents are not easily established in a closed space. When established, the heat losses due to this cause are approximately proportional to the square of the difference in temperature between the bomb and the surrounding air.

The losses due to radiation at the comparatively low temperature to which the bomb is heated are very small. In the small range of temperature (not more than 30° C.) Newton's law of cooling must be an excellent first approximation; this means that the rate at which heat passes by radiation from the walls of the bomb to the surrounding vessel is practically proportional to the difference between the temperatures of these two bodies. The losses due to convection and radiation are negligible as compared to those due to conduction.

The coal under examination is placed on a small tray in the bomb, the latter being filled with oxygen at about 200 lb. pressure. The coal is fired electrically, the maximum temperature rise on the galvanometer taking place about 1½ minutes after ignition. Experiments show that the gas pressure can be varied from 150 lb. to 250 lb., and the weight of coal burnt from 0·2 to 0·7 gramme, without any difference in the results obtained. The instrument is standardised by burning either sugar, carbon, or standardised coal briquets, the calorific values of which are known.

Experiments have been made with materials of largely differing calorific values, and the results have been found to agree excellently amongst themselves. The deflections of the galvanometer are proportional to the calories dissipated in the bomb. In the case of the instrument tested the dissipation of 100 calories gives rise to an E.M.F. of 105 microvolts, and this value per 100 calories is found to be practically constant up to 10,000 calories.

As now constructed, the bomb is made of cast-iron unprotected by any lining such as enamel or platinum. There should be no difficulty in fitting such a protective device, the only drawback being that such arrangements are apt to introduce temperature lag.

The calorific value of paraffin or petrol is determined in the manner originally suggested by Dr. Rosenhain, viz., by soaking a wad of filter paper (which has been weighed and the calorific value of which is known) in the liquid under test. The sample is then weighed, being suspended by a cotton thread which is afterwards hooked on to the electric ignition wire of the calorimeter. In the case of petrol or liquids which evaporate rapidly a piece of tinfoil (the calorific value and weight of which has also been determined) is wrapped round the saturated wad.

The scale of the galvanometer is divided in millivolts, and also in calories on the assumption that a sample weighing 0·5 gramme has been burnt. There is thus no necessity to determine the water equivalent of the calorimeter nor to read the rise in temperature (as is usually done); the calorific value of the coal is found by a single observation. A slide rule will readily convert the values obtained if a slightly different weight of coal has been used. It will be found that if the sample of coal has been weighed previously a complete experiment can be made in less than five minutes.

The instrument is easy to handle, there are no fragile parts, and it is essentially a practical tool.

The Scientific Theory and Outstanding Problems of Wireless Telegraphy.

DISCUSSION.

(Concluded from page 409.)

DR. W. H. ECCLES summarised a long communication describing some of the outstanding phenomena met with in the transmission of electric waves, artificial and natural, over great distances, and examining how far they might be explained on the hypothesis of refraction or reflection of electric waves by masses of ionised air. The favourable influence of the ionisation of our atmosphere by the sun on the propagation of electric waves round the globe was first drawn attention to in a paper read in June last before the Royal Society by Dr. Eccles, in which he showed that the presence in the atmosphere of charged ions of molecular magnitude produced such alterations of the velocity of electric waves through the medium as would have appreciable effect on waves that travelled over long distances. Ions of various sizes were, no doubt, produced by solar radiation. The researches of Leonard and Ramsauer especially had proved that ultra-violet light had a direct action on air, and that, in particular, electrical carriers of molecular size were generated with absorption of light. These carriers, besides, had not nearly so great a power of causing condensation of water vapour as had the "condensation nuclei," usually uncharged, which were produced simultaneously and independently and with comparatively small absorption of light. These uncharged condensation nuclei were formed only where there was water vapour, which probably implied only at low levels of the atmosphere, and had insignificant effect on the velocity of electric waves, while the electrical carriers, which he assumed were found abundantly at high levels where the solar radiation was still unweakened by absorption, had great influence on the velocity of propagation.

The concentration of the ions due to solar radiation must increase as distance from the earth increased, and it was not unreasonable to assume that practically all the ions in the middle parts of the atmosphere were due to solar radiation. A consequence of this was that the velocity of electric waves would increase as height above the earth increased. It followed that a nearly vertical wave front would tilt forward as it travelled horizontally through the middle portion of the atmosphere, or, in other words, a ray travelling nearly horizontally in the middle atmosphere would follow a trajectory curved in the same sense as the earth's surface. In the lower atmosphere, where the ionisation and its rate of variation

with height were small, the ray might not be bent appreciably. Thus, an electric ray starting from a point of the earth's surface in a direction inclined slightly upward, would pursue a straight path in the lower atmosphere and a slightly bent path with its concavity downward in the middle atmosphere. If its curvature here was on the average greater than that of the globe, the ray would be turned down to the lower atmosphere, and again traverse a straight line; but in the other event it went farther and farther from the earth's surface and was lost to us.

It was obvious that, at or above any particular place on the earth's surface, the ionisation in the middle and lower atmosphere increased up till noon and diminished after noon. At sunset most of the ions formed by the sun would disappear rapidly by recombination, and this would leave the atmosphere un-ionised except in so far as local electromotive force might have sifted positive from negative ions during the day. At sunrise there would be great formation of ions. Thus, at the boundary of light and darkness in the atmosphere, there was a more or less abrupt change in the electrical conditions of the medium through which waves had to pass. This region of twilight might be expected to have a much greater influence on the propagation of waves coming from a great distance than on that of waves coming from distances which were not large compared with the height of the well-ionised layers.

Scarcely any of the phenomena to be described could be explained without assuming that there existed in our atmosphere some permanently ionised upper layers capable of reflecting electric waves. This hypothesis was put forward by Heaviside in 1900, but had as yet not been supported by any direct evidence. Besides the implicit evidence in favour of the hypothesis scattered through this communication, Dr. Eccles adduced some considerations from quite another quarter. In 1901 Newcomb made photometric measurements in America of the total light received at the earth's surface from a clear sky on a moonless night, and compared it with the sum total of the measured light from the stars. He discovered that the light actually received greatly exceeded that from the stars. This result had been confirmed by other observers, notably in 1907-8 in Holland, by Yntema, who found the extra light to be perceptibly greater near the horizon than at the zenith. Yntema suggested in 1909 that the extra light might be due to a sort of permanent aurora in the upper atmosphere. It was well known that W. W. Campbell showed in 1895 that the green auroral line λ 5,770 could be seen on clear moonless nights in any part of the sky. This extra light had lately been measured on Mount Whitney by Abbott (August, 1910), with results similar to the preceding. Discussing this "earth light," as it was called, Dr. W. J. Humphreys, in the *Astrophysical Journal* of May, 1912, put forward and supported plausibly the new suggestion that the outermost layers of our atmosphere were kept permanently ionised by bombardment with dust of cosmical origin. An ionised upper layer such as this was exactly what was demanded by many of the facts of wireless telegraphy; but it was very doubtful whether Humphreys' views would be admitted by students of terrestrial magnetism.

In a very important discussion of the degree of conductivity required in the upper atmosphere to justify his theory of the diurnal variations of terrestrial magnetism, Prof. Schuster arrived at a conductivity of the order 10^{-13} electromagnetic units at heights about 100 km. On this basis in the daytime the downward refraction of electric rays at the respective heights named would be so sharp as to be tantamount to reflection. Much lower conductivity than that demanded by Prof. Schuster might suffice to produce beneficial bending of long waves round the earth by ionic refraction in the day.

Turning to the phenomena that had up to the present been revealed by long-distance transmission, the prime fact was the discovery by Marconi in 1902 of the difference between day and night signalling. He found that signals which were readable at night up to 2,000 miles across the Atlantic were not readable in daylight beyond 800 miles. The author explained this by supposing that at night the permanently ionised upper atmosphere acted as a reflecting surface somewhat in the manner of a whispering gallery, while in the day it was put out of action by the ionised middle atmosphere.

Another phenomenon was first brought prominently into public notice by P. E. Schwartzhaupt in the *Elektrotechnische Zeitschrift* of February 3rd, 1910, though it had been previously well known to wireless telegraph engineers. During a voyage from Naples to Genoa and from Genoa past Gibraltar to the English Channel, he measured, roughly, the intensity of certain noon and midnight signals from the Telefunken station at Norddeich. The fact brought out very clearly in these observations was the profound effect of mountains on waves of frequency of the order 1,000,000 per second during the daytime.

Similar observations had been made in various parts of the world.

It was now common engineering knowledge that the evil effect of hilly country on day signals was very much less, being sometimes almost negligible on waves of, say, frequency 100,000, than those of frequency 1,000,000. How were these truths to be accounted for? It was only necessary to assume that in the night the Heaviside layer reflected waves of all frequencies equally well; that the sky was, in an electrical sense, lighted up by the radiation from the sending station and sent rays into the valleys beyond the mountains, the effectiveness of the transmission being greater when the stations were not too close under the hills. In the day the ionised middle atmosphere veiled the reflecting layer, and, to some extent, refracted the waves over the mountains. This refraction was 100 times more potent with a frequency of 100,000 than with a frequency of 1,000,000.

The transition from day to night conditions marked out a period of the greatest interest. The facts given by Marconi were as follows: Waves of length about 4,000 m. (75,000 frequency), crossing the Atlantic from west to east, yielded strong and steady signals all day at Clifden, which gradually weakened after sunset at Clifden, till a minimum strength was reached about 1½ hours after sunset. The signals at Clifden then gradually increased in intensity till after sunset at Cape Breton, when they attained a maximum which was occasionally very high. During the night they were very variable in strength, flickering from very weak to very strong. Slightly before sunrise at Clifden, the signals grew stronger, and sometimes passed quickly to a high maximum. They dwindled to a marked minimum about two hours later, and then returned to the normal day strength. The facts brought out by measurements on the Clifden signals received at the author's laboratory in London were as follows: During the day, signals were weak and not very steady; during twilight, they sank to a minimum intensity at about 20 minutes after sunset at London—that is, when the sun was setting at a place half-way between London and Clifden. After other and erratic fluctuations in strength, they kept increasing in intensity till well after sunset at Clifden. Sometimes at about 10 minutes after that sunset, there came a short interval filled with huge flutterings of signal strength, the sounds in the telephones alternating from faint to loud with great rapidity, just as if the medium conveying the signals were stirred with a vast commotion; and then the signals quickly settled to their normal night strength, which, it must be noted, was always greater than their normal day strength. Similar phenomena, less pronounced, might be witnessed at sunrise.

It would be well to offer an explanation of these phenomena. In the first place, it was clear that when at sunset the rotation of the earth carried a region of the middle or upper atmosphere out of the sunlight, recombination of ions must take place on a vast scale. Similarly, at sunrise formation of ions would take place. The regions in which these changes were occurring formed a great circular belt round the globe which was inclined to the meridian at an angle depending on the season. This belt of electrical disturbance was, of course, perpetually revolving round the globe. The ionisation occurring in the sunrise half of the belt, and the recombination occurring in the sunset half, might both be expected to take place with some degree of irregularity even in a still atmosphere, with the result that patches or banks of ionised air, analogous to the banks of fog met at sea, would transiently overhang the parts of the earth's surface that were in dusk. It was probable that these irregularities were greater in the sunset half of the belt than in the other, for it was not unlikely that considerable separation of ions of opposite sign might take place in the course of the day under local electromotive forces. In any event, the effect of such patches of heterogeneously ionised air on waves propagated through the region was, in view of the connection between the velocity of the waves and the concentration of the ions, to produce scattering by repeated refractions. Hence it was to be expected that the regularity of transmission through the steady ionised horizontal strata of the illuminated air would be greatly disturbed by the arrival of the twilight transitional patches, with the ultimate consequence that the signal sounds heard in the receiving telephones would be weakened. The author's own observations on the influence of ordinary cloud on signals proved that the ionically turbulent belt was above the ordinary cloud level, and thus it might be regarded as a sort of curtain enringing the earth and occupying the middle atmosphere without reaching the lower. It affected, therefore, the trajectories of waves received from great distances, and not those from small.

In the language of this hypothesis, Dr. Eccles expressed these facts of trans-Atlantic telegraphy by saying, first, that during the day refraction in the ionised middle atmosphere bent some of the rays from Cape Breton directly to Clifden, perhaps with absorption; second, that after sunset at Clifden, but before sunset at Cape Breton, the radiation from the latter was refracted along a curved trajectory in the part of the middle atmosphere still illuminated, penetrated the twilight belt, and was assisted further round the bend of the earth in the dark by the Heaviside layer; third, as the twilight belt moved westward, it marked the annihilation of a refracting structure in which propagation was good, and the establishment of a reflecting structure in which, also, propagation was better than in the belt itself. There would be, therefore, a position for the belt that would bring about a minimum of signal strength, and this was, in fact, reached when the belt was not very far below the horizon of the receiving station; and, fourthly and finally, when the twilight belt had passed above or behind the sending station, it appeared that it could strengthen signals in a fitful, fluttering way by a process of reflection, or, less probably, by some lens-like action. It might be added that if the principle of optical reversibility were applicable here, then signals in each direction should show simultaneous ups and downs in intensity; but there was not any information available on this point. Taking, now, his own observations on the propagation from Clifden to London, about 440 miles, he found that propagation in daylight was always worse than in the dark, which was quite contrary to trans-Atlantic experience; and he might interpret this as showing that the Clifden radiation passed in daylight high above places at distances like 400 miles to descend again at distances of 1,000 or 2,000 miles. When the twilight belt passed behind Clifden there were great fluctuations in intensity, possibly due to reflections, just as in the trans-Atlantic case. All these remarks on sunset phenomena might now be translated into corresponding statements about sunrise.

The natural electric waves that diverge from lightning strokes or other atmospheric discharges, often travel long distances over the globe, and therefore exhibit the effect of the twilight belt. These natural electric wave trains make themselves evident in wireless telegraph apparatus by knocking or clicking sounds in the

operators' telephones. These strays as they are called for short, are in our latitude usually more frequent at night than in the day, both at land stations and at ship stations, and near sunrise and sunset the day conditions merge, of course, into the night conditions. The transition at sunset was carefully observed by Dr. Eccles during passages across the Atlantic in the summer of 1909. It was found that the transition was usually abrupt and at about 10 minutes after sunset. In November, 1909, he started making records of the strays received near sunset at his laboratory in London, and immediately came across a remarkable phenomenon, which, it turned out, happened also at dawn. Starting to listen about a quarter of an hour before sunset on a favourable afternoon in late autumn or winter, the strays heard in the telephones were few and feeble, as they had been all day; then at five minutes after sunset a change set in, the strays slowly got rather fewer and feebler, till at 10 minutes after sunset a sudden distinct lull occurred and lasted perhaps a minute. Often at this period there was a complete and impressive silence. Then the strays began to come again, they quickly gained in number and force, and in the course of a few minutes they settled down into the steady stream of strong strays proper to the night. The lull was sometimes very pronounced, and sometimes there was no lull at all, but merely the change from one condition to the other. The latter seemed to be the more usual event at dawn. He believed that most of the strays in temperate latitudes had their origin during the cold season in the tropics, and that, in consequence, the bulk of those arriving at his laboratory in London came from a southerly direction. In this case they had to traverse the twilight belt of electrically-disturbed air very obliquely, with the result that he observed a short-lived, but very complete, cessation of strays while the belt passed approximately over London. In the same paper he attributed the relative feebleness of the day strays to dispersion occurring in the ionised middle atmosphere with, possibly, absorption. This stray minimum had been independently discovered and investigated by Dr. Marconi and his research staff.

During the progress of the solar eclipse of April 17th last a record was made of the strays received at the author's laboratory in London. The results agreed with the deduction already drawn from the stray minimum at sunset; and, taking it as an established fact, they might conclude from these eclipse observations that the re-combination of the atmospheric ions on the grand scale proceeded much more rapidly than the making of ions; which in its turn threw light on the fact that the sunset stray minimum was more marked than that occurring at dawn. Marconi in his recent Royal Institution discourse had pointed out that the attainment of extraordinary distances was more common in the north-south direction than in the east-west direction. Dr. Eccles thought the cause of this lay in the probable ionic irregularities left in the wake of the twilight belt as it passed round the globe. If the positive and negative ions became separated to any extent in the day, as was quite possible, their complete immediate re-combination at twilight was rendered impossible, and therefore patches of ionised air were left behind. It was clear that these patches were likely to have a general disposition parallel to that of the twilight belt of which they were fragments, having the form of irregular ribbons that followed the meridians more or less closely according to the season. Their presence would make east-west propagation rather more difficult than north-south. These floating ribbons or streaks of ionised air which he had postulated offered, if they really existed, an easy explanation of the perpetual variations in strength of long-distance signals during the night. Indeed, on listening to the rising and falling of intensity on a bad night, it was impossible to resist the thought that colossal semi-transparent screens were being moved about between the sending station and the listener.

There seemed to be no doubt that signals passed badly through an area in which a great storm was raging. It was obvious that violent winds might destroy the uniformity of the electrical stratification of the middle atmosphere in the day, and might similarly affect the position and condition of the upper reflecting layer.

The last phenomenon he need refer to in this section was the effect of the aurora on the propagation of waves. Mr. C. H. Taylor worked with some stations of the American Marconi Co. near the Arctic circle some years ago throughout three winter months. He found that the aurora exercised a most profound effect on signals, and always a favourable one. Sometimes when signals were too bad to read, the arrival of an aurora instantly brought good communication. The effects were greatest when the aurora extended all round the zenith. Since then it had been remarked that even as far south as Montreal, freak ranges were most common on nights of brilliant auroral displays. If it were permissible to identify the upper conducting layer of Heaviside with the strata in which the aurora formed, this connection between auroræ and signals proved positively that the upper layers did come strongly into play even in the distance of about 100 miles worked over by Mr. Taylor. The question of the height of the aurora was of interest in this connection. Störmer determined the height photographically as varying from 40 km. to 370 km. Accepting this, it seemed to be proved that electric waves travelling 100 miles at night might be affected by the state of affairs in regions of the atmosphere more than 25 miles high.

Prof. Howe, of the Imperial College of Science, described his method of teaching the principles of wireless telegraphy by treating it as though it were a power circuit with a transmitter as the source of energy and the receiver as the motor at the other end.

Prof. S. P. Thompson said that in 1894, at Oxford, Sir Oliver Lodge showed them the wireless transmission of signals from one building to another, across several stone walls, and as Sir Oliver's name had not been mentioned in this discussion, he would like to point out how absolutely impossible would have been the diagrams on the walls or the practical transmission of signals for 1,000 miles and upwards without his work. It was very undesirable that they should lose sight of the fact that Sir Oliver Lodge was entitled to great credit for what had been accomplished in long-distance telegraphy.

Lord Rayleigh, President of the Royal Society, said that, since he first heard of the wonderful results obtained by Mr. Marconi in signalling across the Atlantic, he had always felt there was a difficulty to be explained that could not be explained so long, at any rate, as they regarded the earth as a perfect conductor and the air as a simple dielectric. He thought that view seemed now to be generally accepted, and the only thing was now to see in what direction they could look for an explanation of signalling round, so to speak, the corner of the earth. They had the theory of Sommerfeld, who came to the conclusion that the imperfect conductivity of the earth facilitated the curvature of the waves round the surface, and so would help towards explaining the difficulty. That might be so. For himself he would look along the lines of Dr. Eccles. It seemed to him that the facts required some such explanation. The differences between night and day, and N. and S. and E. and W. signalling, could hardly be explained on the comparatively simple principles adopted by Sommerfeld. It seemed to him that these complications required a more variable element than they could argue from the imperfect conductivity of the earth. They were very easily explained by certain changes going on in the atmosphere, and he hoped that in that direction a complete explanation would ultimately be found. There was one point which Prof. Fleming referred to, namely, the difference found between the sending and receiving antennæ. There was a general mechanical principle, the principle of reciprocity, which this would seem to contradict. He thought it would be worth while for those who were pursuing these subjects to try to make out more clearly whether the best sending antennæ were not also the best receiving antennæ as the principle of reciprocity would suggest.

Prof. Kennelly, of Harvard, said he would confine his remarks to conjectures on the daylight disturbance effect, for which purpose he showed a number of slides. One showed the relative intensity of signals received at different hours of the day as given by Dr. Pickard. Another slide showed the observations taken more recently in the neighbourhood of Boston. What they wanted, he said, was an organised arrangement for making observations. Up to the present time all information they had on this point had been obtained from amateurs, and not from professional radio-telegraphists. Amateurs might be able to perform very valuable services under a committee of the association.

Prof. A. G. Webster remarked that the difficulties of receiving were most easily to be solved if they took the analogy of sound which was conveyed through the medium of the air, and considered how they were to depend on homogeneity if they were to have any success at all. How could the interior of the earth be expected to be homogeneous throughout thousands of miles? He did not see how they were to get on with any theory which said nothing about the surface conditions in considering the interior of the earth. If there was one phenomenon about wireless which struck one more than another, it was how good it was over the sea and how bad over the land. The sea was homogeneous. Of course, the fact that the daylight had such an effect showed that there was a good deal going on above the surface of the earth. Prof. Sommerfeld had been obliged to make certain approximations. Were these approximations correct? Lord Rayleigh said he could not tell in two weeks; he (Prof. Webster) could not tell in two years! These calculations of Sommerfeld had been made with great mathematical skill. He had great hopes that co-operation in the matter would lead to more success than they had yet attained.

Major Squier said there was a gap between the wire art and the wireless art which needed to be attacked, and he wished to call attention to some experiments undertaken by the United States War Department some time ago. The view taken in carrying out those experiments was that frequencies below the present wireless frequencies could be studied by using them on the wires by means of the wireless apparatus—in other words, using wireless methods in conducting experiments on wires. Such experiments had been conducted, and he had the pleasure of reading a paper on the results at a meeting at Chicago. It was found that they had to have a source of sustained oscillations, and for this purpose a high-frequency alternator was designed. By using a storage battery they could have available oscillations that would not die down for hours at a time. Experiments were made with frequencies of 20,000 to 100,000 on actual lines. The first thing noticed was that within this range the energy required to transmit was extremely small compared with the use of wireless antennæ. In fact, the present antenna system was ridiculously low in efficiency. The advantage of attacking the problem in this way was that experimental data were easily obtained without interfering in the least with the ordinary telegraphic signals passing over the lines. They had no trouble with the daylight, and the variations of an air circuit were avoided.

Dr. J. W. Nicholson said with regard to Sommerfeld's theories that he had occasion some time ago to go very carefully through those calculations. It was a difficult matter. There was one point where they might be at fault. Lord Rayleigh suggested that it hardly seemed likely that imperfect conductivity could give a better effect than perfect conductivity, but remarked that first impressions were not always right. He (Dr. Nicholson) was tempted to believe now that it was a case where they were right. The point in doubt was whether they could really extend the analysis to an actual curved surface. He was very much tempted to accept Dr. Eccles's explanation, which attracted him very much, and he thought it was the key to the greater part of the explanation.

Mr. S. G. Brown explained some experiments he had carried

out. He said sometimes they could only signal with very great difficulty, and then all at once the waves would brighten up enormously without any apparent reason. The difference between night and day sometimes had nothing to do with it, and the weather had not changed.

PROF. BAILY said the earth waves must necessarily exist. They were part and parcel of the Hertzian waves. In connection, however, with the resistance of the earth, he had been doing experiments which convinced him that they could regard the earth as an imperfect conductor. But oscillations would only penetrate some distance, less than 50 miles, which, compared to the size of the earth, was a mere skin effect; and at about 60 miles deep the conductivity of the earth increased with considerable rapidity.

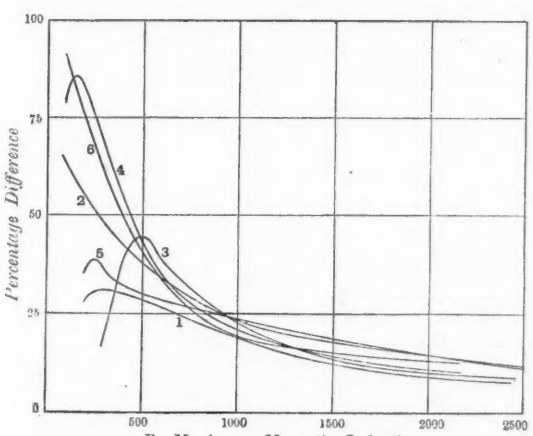
PROF. FLEMING said they had no existing data about the radio-telegraphic condition of the atmosphere as to ionisation, &c., and, therefore, he ventured to think that much valuable work could be done by a radio-telegraphic committee to carry out experiments rather than by theorising on the subject. A number of necessary facts were still conspicuous by their absence. He again urged that a Committee should be at once appointed for the work.

On the Importance of Previous Magnetic History to the Engineer.

By ERNEST WILSON, B. C. CLAYTON and A. E. POWER.

A GOOD deal has been written upon the subject of previous magnetic history and the present paper compares results obtained from a 3-KW. 60-frequency transformer with those obtained by the ballistic galvanometer method. By aid of a point-to-point method the curves of impressed voltage and current in the primary coil of the transformer were observed. The frequency in all cases was 59 and the transformer was not loaded. The transformer in any one experiment was first carefully demagnetised by gradually reducing the current in its primary coil from a value corresponding to the previous history force to a very small value and then allowing the alternator to slow down and come to rest with its exciting current still on. Care should be taken with the frequency in such tests that the voltage of the transformer is not raised beyond safe limits. The curves of impressed voltage and current were then obtained for the given chosen value of the maximum magnetic induction B. The alternating current was then cut off, and such a current passed through the secondary coil from a set of storage cells that the force H was about 26 C.G.S. units. This force was then removed and the alternator again switched on, and curves of impressed voltage and current again observed. The value of B in this last case was not exactly equal to that in the former, but this difficulty was got over by plotting curves and interpolation.

In the figure the Curves 1 and 2 show the percentage increase in the watts and primary magnetising current respectively in terms



Watts	Transformer	Curve	1
Ergs	Stalloy ...	,,	3
,, ...	Lohys ...	,,	5
Magnetising current ...	Transformer	,,	2
,, ,, ...	Stalloy ...	,,	4
,, ,, ...	Lohys ...	,,	6

FIG. 1.

of the maximum magnetic induction B after the application of the previous magnetic history force. The effect is so stable that no change was produced after running the alternator for the purpose of observing the curves, and it is possible that in certain cases, for instance, in the current transformer, these effects may have considerable importance. It will be seen that the watts due to magnetic hysteresis and eddy currents are increased 30 per cent. or more and the magnetising force is increased by nearly 50 per cent. when the magnetic induction has a value of about 300. So far as ordinary power transformers are concerned, in which higher values of B are used, the effect is less pronounced. With the value of B 5,300 the percentage increases in the watts and magnetising current respectively are 1·4 and 9·5.

Turning to ballistic galvanometer experiments, in the case of Stalloy and Lohys it will be seen from the figure that the percentage increase in the ergs per cycle per cubic centimetre and the magnetising current due to the application of a previous history force of about 26 C.G.S. units, vary very much in the same way and confirm the results obtained with the transformer. In Stalloy the ergs increase by as much as 45 per cent. for B 500, and the magnetising current 85 per cent. for B 150, on the values these magnitudes would have if the effects of previous history force were wiped out by careful demagnetisation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Prevention of Corruption.

It seems, from inquiries which have reached me, that the provisions of the Prevention of Corruption Act, which forbids under heavy penalties of fine or imprisonment, the asking for, or receiving, the offering, or giving, of bribes or secret commissions, are still unfamiliar.

Many persons in the electrical industry appear to be equally unaware of the existence of the Secret Commissions and Bribery Prevention League (Inc.), (president, the Right Hon. Sir Edward Fry, G.C.B.), which was formed to enforce the Act, to advise, warn, and if necessary, to prosecute, and has a large and influential membership.

The British Electrical and Allied Manufacturers' Association is affiliated to the League, and therefore any company or firm belonging to the Association may join the League at the minimum subscription of one guinea. The subscriptions of all members who join now are available for the period ending December 31st, 1913.

If any of your readers desire any information which it is within my power to give, I shall be glad if they will communicate with me.

The Secretary of the
Secret Commissions and Bribery Prevention League (Inc.).

3, Oxford Court,
Cannon Street, London, E.C.

Industrial Engineering.

Now that the question of scientific shop management, under various systems, is receiving some attention, perhaps the following comments may interest your readers.

The industrial engineer, as such, is practically unknown in England, although I believe that in America industrial engineering is a recognised branch of the engineering profession.

The duties of the industrial engineer consist, principally, in the handling and organisation of labour, and in the economic production of parts from the raw material to the finished article, by some manufacturing process.

It is frequently urged in engineering discussions that the works manager, shop superintendent, or whatever he may be called, is not an engineer in the true sense of the term. This is quite true in the majority of cases. It is the duty of these men to superintend the production of apparatus or plant from a manufacturing and also from a commercial standpoint.

To accomplish this, the works manager—particularly in a large concern—must have a good knowledge of mechanical engineering, as regards machine work, a good knowledge of shop costing and accounting systems, and also a fair knowledge of the particular branch of work for which the manufactured article is used. Needless to add, he must be a capable organiser and a man of some personality.

Is not this man, then, as important as the engineer whose duty consists in designing or improving designs? By all means; for of what use is the design unless the article can be produced in the most economical manner, particularly in these days of keen competition and cut prices?

I am not aware of the existence in England of an association or other body of industrial engineers.

Having in mind the great part which industrial engineering must play in the future, particularly in the electrical industry, I think that there should be some association or body formed which shall have for its main objects the bringing together of works managers and other men having control of manufacturing operations, and to discuss (1) labour problems ; (2) labour-saving devices ; (3) factory planning and organisation, and the many other problems which face the manufacturer of to-day.

I should be glad of the opinions of readers whom this may interest.

H. N. Munro.

London, *September 20th*, 1912.

Switchboard Fires.

No one will deny the knowledge which Mr. Hubert Berry possesses of the merits of the productions of his own company, and his letter in the "Correspondence" columns of your current issue is evidence of his assiduity in imparting his knowledge to other people. Such being so, one would have hoped that he would have disdained the assistance obtained by trotting out the old fetish as to the alleged advantage of a switch in which the current does not "pass through its hinges." Instead of this being necessarily an advantage, it is, other things being equal, a disadvantage. If the volt-drop be measured across the contacts of a modern knife switch, it will be found that the "hinge" contact has a better conductivity than the break contact ; a superiority which might be claimed for a switch in which the current does not pass through the hinge, is that in the off position the blade is dead. This, however, does not apply with an ironclad switch, and on an open type of board the source of supply, if the design of the board be good, is connected to the top (or break) contact. It follows, therefore, that this advantage does not amount to much. Moreover, it may be taken as a universal truth that the simpler an apparatus is the better. Any requirement, therefore, which prevents a simple construction, without any good reason, is strongly to be deprecated.

Charles C. Garrard.

Sutton Coldfield, *September 23rd*, 1912.

The Textile Institute.

I shall be obliged if you will allow me to reply through your columns to the many applications I have had from your readers for particulars of membership of the Textile Institute.

Membership of the Institute is open to anyone engaged in the textile and allied trades, which, of course, include all who are interested in furnishing power, light, and all kinds of textile machinery. It was frequently stated by engineers who spoke at our Hawick Congress that the Institute had justified its existence even if it had done nothing else but form a common platform on which steam, gas, oil, and electrical engineers could meet and discuss power problems from a common point of view. The series of papers which were given at Hawick are only the beginning of a complete investigation which this Institute purposes to make into the whole subject of "Mill Driving." I use the term "Mill Driving" not only to include prime-movers, but also the various methods of distributing power. An early opportunity will be taken of having a series of papers on this latter feature, in which an opportunity will be given for those interested in the various forms of power distribution to state their cases.

May I take this opportunity, Sir, of thanking you for the excellent report you have given of our Congress proceedings, and of expressing the hope that our work may continue to merit such recognition? I shall be very pleased to send a circular giving details of what the Institute is, and what it is doing, to any of your readers.

Geo. Moores,
Secretary, The Textile Institute.

14, Cross Street, Manchester.
September 24th, 1912.

LEGAL.

Earnshaw *v.* Braulik.

In the City of London Court, on Thursday last week, before Judge Rentoul, K.C., and a jury, Mr. S. W. Earnshaw, 64, Carlisle Road, Hove, claimed £21 against Mr. G. Braulik, manufacturer of electrical supplies, 8, Lambeth Hill, Queen Victoria Street, E.C., for three months' salary. Mr. Gervase Rentoul appeared for the plaintiff and Mr. Harold Morris for the defendant. Plaintiff's case was that he was employed by the defendant in March last as a traveller. He had had no previous experience in electrical supplies, and was paid 35s. a week, 7s. 6d. for daily expenses, third-class railway fares, as well as 1¼ per cent. commission on the business which he did. Defendant stipulated that he should agree not to join any competitive firm if he left the defendant for any reason, or forfeit £50. In that the plaintiff concurred. Plaintiff travelled for the defendant for some time, and was dismissed in May with a week's notice. As no term of notice had been agreed upon, plaintiff said he was entitled to three months' notice, that being the custom of the electrical trade. Defendant had since suggested that the plaintiff was engaged on trial, and that his travelling was disastrous. Plaintiff said that was quite untrue, and that the coal strike made business "terribly rotten." Defendant was sometimes short of stock. Defendant told him he would have to be responsible for bad debts that he made. He based his claim to three months' notice on "Law for the Million." Mr. Morris feared that that did not govern the Court. The plaintiff was engaged as a weekly servant, and was engaged on trial. It was a failure, and plaintiff was discharged. There was no custom about three months' notice. Defendant was never short of stock. Plaintiff's turnover was only £75, of which his expenses and salary came to £32. Business could not continue in that way. Plaintiff was only too glad to get his job ; but defendant did not mind plaintiff getting employment with any other electrical firm now.

Evidence was given in support of the plaintiff's case as to custom ; while, for the defendant, the assistant secretary of the General Electric Co., Ltd., said that in the case of commercial travellers no such custom existed.

The jury could not agree as to the custom, but they thought the plaintiff ought to have had six weeks' notice.

Judgment followed for the plaintiff for £8 15s., and costs.

Farsley U.D.C. *v.* Bradford Corporation.

At the Bradford West Riding Court on Monday the Bradford Corporation was summoned by the Farsley U.D.C. for payment of £13 15s., stated to be the balance due under the general district rate in respect of the tramways within the Council's area. It was stated that the Corporation had paid the poor rate in full, but only one-fourth part of the general district rate, the balance of the latter being withheld on the ground that it was liable to pay only a quarter under the Public Health Act of 1875.

Mr. F. Thornton, collector and assistant overseer at Farsley, said the summons had been taken out in order that the Council might be safeguarded. The contention of the Corporation had been upheld in a case that had been before the Courts, but an appeal had been lodged, and he asked for a remand pending the result of the appeal.

Mr. N. B. Fleming, deputy town clerk of Bradford, said the case referred to by Mr. Thornton was that between the Metropolitan Electric Tramways, Ltd., and the Tottenham U.D.C. The lines in the Farsley district were constructed as a light railway under the Light Railways Act, and the attitude of the Corporation was upheld by the decision of the House of Lords in the Wakefield case. The decision of the House of Lords in the Tottenham case would not apply in the present instance. In Tottenham there were two kinds of tramways —the tramway laid under the Tramways Act and the light railway— and in that case the rating authority called upon the tramway company to pay the full rate in respect of the tramway without contesting the question of the light railway, agreeing that a fourth of the rate was a proper figure.

The Magistrate's Clerk (Mr. W. B. Cragg) inquired whether the Corporation had not power, under the Tramways Act, to build the railway.

Mr. Fleming said they had a double order, but they constructed it under the Light Railways Act.

The case was adjourned for three months.

Brompton and Kensington Electric Supply Co., Ltd., *v.* Earl's Court, Ltd.

At the West London Police Court on September 18th, an adjourned summons was down for hearing, in which the plaintiff company sought to recover from defendants, the proprietors of Earl's Court Exhibition, the sum of £87 18s. 4d., balance of an account for the supply of electrical energy from July 1st to August 1st.

Mr. Lynch was for the plaintiffs, and Mr. J. Lamb represented the defendants.

It appeared from the evidence that in the early part of the year the companies entered into a contract for the supply by the plaintiffs of electrical energy to the defendants' exhibition for the purposes of lighting and power. After the exhibition was opened, however, the defendants opened the Electric Restaurant, where a large proportion of current was used for heating and cooking. For this purpose two subsidiary meters were connected with two of the

primary meters in the building, each of them registering how much current had been used for heating and cooking, but all units passing through these subsidiary meters had, first of all, passed through the primary meters, and, of course, were charged for at the lighting rate. According to the agreement, electricity for lighting purposes was to be charged for at 2d. per Board of Trade unit up to 75,000 units; above that number at 1¾d. per unit, and above a further quantity at 1½d. per unit, while energy for power was to be charged for at the uniform rate of 1d. per unit. The plaintiffs now claimed the balance of an account of £132 for the month of July. For the defendants, it was contended that the current used for heating and cooking at the electric restaurant should be chargeable either at the power rate or at a reduced charge, the ordinary rates to general consumers being quoted to show that the rates for heating and cooking were two-thirds lower than those for lighting. Mr. Williams, the secretary of the plaintiff company, admitted that his company was interested in the electrical cooking exhibit, but was unable to say whether the company erected it. Mr. W. A. Woodhouse, managing director of Earl's Court, Ltd., stated that the exhibit was installed with the knowledge of the plaintiffs, who had an interest in it. The plaintiffs were aware also, he said, of the subsidiary meters, which, he added, were read by the plaintiffs' meter readers.

Mr. Fordham suggested that the parties should split the difference in the disputed charges, and that the defendants should pay 1½d. per unit for the current used for heating and cooking, but Mr. Lamb intimated that that course would raise a question as to previous amounts that had been paid.

Mr. Lynch said he should ask for the full amount.

Mr. Fordham gave judgment for £26 4s. 6d., with two guineas costs.

Both parties asked his Worship to state a case, and Mr. Fordham agreed to do this if a point of law was placed before him at a later date.

ELECTRICAL EXHIBITION IN BAHIA BLANCA.

To Mr. A. C. Kelly, the chief electrical engineer of the Ferro Carril de Buenos Ayres al Pacifico, Buenos Ayres, we are indebted for the accompanying picture showing an Electrical Exhibition which was held in the South American Hotel at Bahia Blanca, from August 6th to 20th. The exhibition was carried out by the South American Light and Power Co., which is managed by the electrical department of the above railway, and was, it is believed, the first exhibition of its kind in Argentina. The exhibits were intended to illustrate to the people of Bahia Blanca the many domestic uses to which electricity might be put, and they included small-sized motors, various types of heating and cooking apparatus, hot-plates, kettles, ozone generators, irons, vacuum cleaners, &c. A special feature was made of electric cooking, which was shown in operation, but the collection of this apparatus does not appear in our photograph, being further to the left than our picture shows.

Electrical Exhibition at Bahia Blanca.

Mr. Kelly is of opinion that there ought to be a good field for electric cooking in Argentina, as the cost of fuel is very high, whilst the cost of electricity in general is fairly reasonable. He adds, however, that electric cooking apparatus will have to be robust, simple and cheap, and, above all, the design must be so arranged that renewable heating elements, which must be interchangeable, can be readily fixed without requiring very high-grade labour. Mr. Kelly expects to be in London at the end of this year, when he will go further into this matter, as he proposes to start a hiring-out system for electric cookers.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Novelties.

The General Electric Co., Ltd., have lately brought out several new devices, presenting considerable novelty. Amongst these is the adjustable reading lamp illustrated in fig. 1. The lamp can be fixed in any desired position so as to produce the most comfortable effect, without removing screws or bolts, and it is provided with a revolving shade which enables the light to be projected in any direction, whilst also protecting the eyes from direct glare.

Fig. 1.—G.E.C. Adjustable Reading Lamp.

Fig. 2.—G.E.C. Electric Kettle.

Another novelty is an electric kettle, fig. 2, in which all parts are standardised and are perfectly interchangeable; the heating element is readily replaceable, and is held in position against the bottom of the kettle by a stout clamping plate which carries the connecting socket, with the aid of three little bolts. An insulating sheet between the plate and the external protecting case prevents downward flow of heat, and the cover is so arranged that the vital parts are protected and hidden from sight. The kettle is made in two sizes holding 2 and 3 pints, and for 100-120 or 200-250 volts.

We illustrate in fig. 3 a new electric iron, the "Magnet," which

also is composed of interchangeable parts; the heating element is practically indestructible, and is in close contact with the sole of the iron, care being taken to ensure that the point of the latter is kept

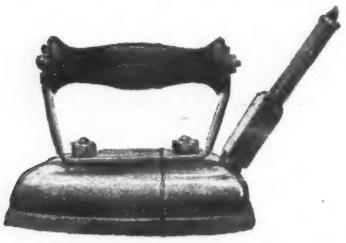


Fig. 3.—The G.E.C. "Magnet" Electric Iron.

hot. A couple of nuts hold the parts of the iron together, and the connections are made automatically when the iron is screwed together. It is made in 4-lb. and 6-lb. sizes.

Bell Transformer.

Our illustration, fig. 4, shows a patent bell transformer for primary voltages up to 250 and three different secondary voltages (3, 5, and 8), which has been placed on the market by the

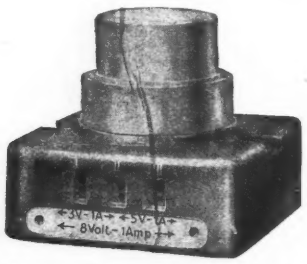


Fig. 4.—Variable Voltage Bell Transformer.

Indestructible Cable Co., of 20, High Holborn, W.C. The transformer weighs only 1 lb. 12 oz. and can be supplied for a higher primary pressure; it is suitable for operating any class of bell circuit.

G.E.C. Home Office Fuses.

In order to comply with the Home Office Regulations regarding fuses, the General Electric Co., Ltd., have recently produced a patented adaptation of their well-known "Bobbin" fuse. The new fuses are made up of porcelain holders, with heavy brass castings giving ample contact area and radiation surface. The

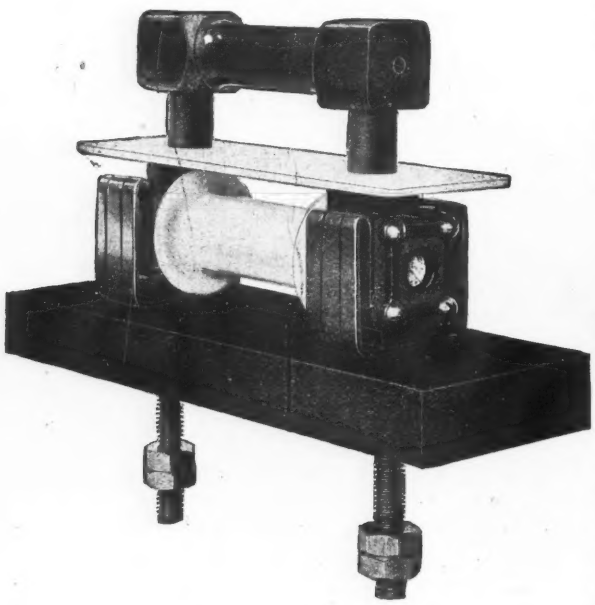


Fig. 5.—New G.E.C. Fuse.

lignum vitæ handles are protected from any possible arcs by fireproof megorin shields, and are made in two slightly different styles, for "open type" and "iron-case" mountings, the latter being arranged so that shallow cases only are required. They are made up in single water-tight cases or in larger ones to form multi-way distribution boxes. Fig. 5 shows the appearance of the open type.

G.E.C. Miniature Immersion Heater.

The G.E.C. electric immersion heater, fig. 6, which can be readily attached to any electric lamp socket, is a very handy little device, somewhat like a stout pencil, measuring 7 in. in length, and with a diameter of ¾ in. All that is necessary to heat a cup or glass of any liquid is to plunge this G.E.C. immersion heater into it, and

Fig. 6.—G.E.C. Immersion Heater.

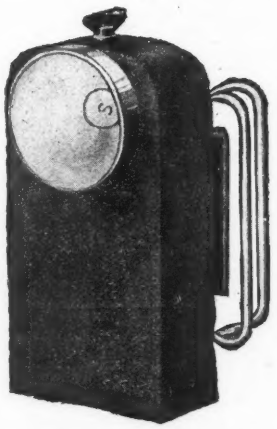


Fig. 7.—"Municipal" Police Lamp.

switch on the current. Within a short time, water, tea, coffee or milk can thus be heated, and eggs can also be boiled. The heater is a straight, smooth cylinder, without corners or projections, heavily nickel-plated; it is perfectly sanitary, as it has no crevices and can, therefore, easily be cleaned. It should prove invaluable for the nursery or sick room, and it is claimed that travellers will also find it of great use.

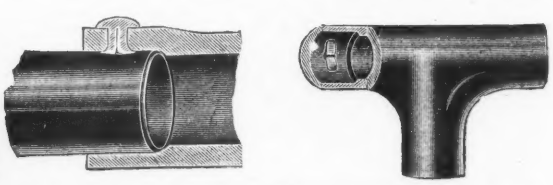
Police Electric Lamp.

Messrs. Ward & Goldstone, of Springfield Lane, Salford, have sent us particulars of their latest portable electric lamp for the use of the police, called the "Municipal" lamp, which we illustrate in fig. 7.

It consists of a strong pressed steel case, with a strap hook and collapsible handle, and is fitted with an efficient reflector and a 4-volt metal-filament lamp. A dry accumulator, automatically making its own connections, is housed inside the case, and a brilliant light is obtained when the switch on the top of the lamp is turned. The lamp is built for strength and reliability, and ought to be found a vast improvement on the old-fashioned hot and smoky lanterns still generally used by the police, for whose purposes the electric lamp is ideally adapted.

The Anchor Patent Grip.

Messrs. Electrical Conduits, Ltd., of Anchor Works, Walsall, have introduced a new continuity grip for slip conduit work, which we illustrate herewith. It will be seen that the fittings are bored through a thickened part, and an ordinary bifurcated metallic rivet is inserted and hammered home, the points



Figs. 8 and 9.—Sectional Views showing the Anchor Grip in use.

being thus spread apart; at the same time the enamel is removed from the surface of the tube, and the rivet makes firm metallic contact with the latter. Should it be necessary at any time to withdraw the rivets, this is effected with a specially shaped pliers. The advantages claimed for the device include simplicity, neatness, quickness in fixing, perfect electrical continuity and a strong mechanical joint at trifling cost.

The P. & G. Electric Cooking Plate.

The cooking plate here illustrated is supplied by Messrs. Perry and Grinsell, Ltd., of Leopold Street, Birmingham, and is listed in three sizes, taking respectively 600, 800-200 and 1,500-375 watts They are substantially constructed of cast-iron, and the outer disk completely covers the whole of the element, which is thereby protected from moisture, &c. Each plate is sup-

ported by point contacts on a suitable stand, and may be used with perfect safety without fear of burning the table. A suitable switch (Diamond H) is provided, which is mounted on a cast-iron arm, and sufficiently far from the plate to avoid spilt liquids. All

FIG. 10.—P. & G. ELECTRIC COOKING PLATE.

the connections are well protected. The makers, having met with a demand for a cooking plate suitable for hiring out, have developed this design especially for the purpose.

New Glassware.

We understand that the BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, 77, Upper Thames Street, London, E.C., are shortly placing on the market two new patterns of glassware, which will be known as "Opalux" and "Veluria." These reflectors are made in several forms to give varying distributions of light, and are said to be extremely beautiful in appearance both when lighted and unlighted. Tests made on them show that as regards reflection and distribution of light they are highly efficient.

BUSINESS NOTES.

Consular Notes.—Tripoli.—The American Consul at Tripoli, reporting on the possibilities of trade resulting from the Turkish-Italian war, states that the most important industrial enterprises to be established here since the occupation are the electrical companies, Societa Commerciale d'Oriente and the Esercizi Elettrici della Libia; the former is a Venetian company, the latter a Milan enterprise. The first took over the small plant that was installed last year by the Banco di Roma, and added at once an engine by which it has been able to develop 110 H.P. It will shortly have in working order three Diesel sets, each with a capacity of 200 H.P. Space is provided for the addition of three turbines of 1,000 H.P. each, if the demand should develop. The Milan company is installing a Diesel set with a capacity of 150 H.P. It has already secured more than 200 customers for lighting.

Mexico.—The American Consul, reporting from Mexico at the end of June, stated that the Mexican Telephone and Telegraph Co., an American-owned concern with headquarters in Mexico City, had been granted a concession by the city of Guadalajara to put in an entirely new telephone system and give this city a service modern and up-to-date at a cost of about $250,000 gold, with wires underground throughout the city. Work will commence at once, and the system will be in operation in about 1½ years; as American capital controls the company, American methods, apparatus, and material will be used wherever possible. The company also plans to connect Vera Cruz on the east coast with Manzanillo on the west, thus giving long-distance telephone service between the connecting cities, which include some of the most important in the Republic—Orizaba, Puebla, Mexico City, Queretaro, Celaya, Guanajuato and Guadalajara.

China.—The American Consul at Shanghai recently reports that an interesting feature of the present industrial development of Shanghai is the growing use of electrical power. Over 2,000 H.P. are connected to the mains, but prospects are that this will be about trebled. There are plans which will practically double this consumption immediately and within the next 18 months the further development mentioned may be looked for. The cause of this expansion is largely the increase of industrial activity in Shanghai. Among the new customers for power will be the rice mills now being erected. Along the banks of the Soochow Creek these are springing up. Their busy season is from October to March, while during the rest of the year they are intermittently at work. The orders for these mills will put a load of 500 extra horse-power on the mains. Besides rice mills, cotton mills under construction call for a considerable further extension. One Chinese mill of comparatively small size is to have an electrical power installation of 280 H.P., and a second mill of larger capacity has ordered 450 H.P. Two other mills have in contemplation the installation of electrical plant. One of these is for 1,000 H.P., and the other for 1,500, and as these will require the power in the course of next year, it will be seen that there will be a full demand upon the producing capacity of the works. The new works are expected to be ready about November, and with these orders, as well as gauging the demand from past experience, it is anticipated that by the time they have been in operation for 12 months they will be required to work at their full capacity.

Spain.—The American Consul at Madrid, reporting on the trade of his district, states that there are many waterfalls and rivers in Catalonia, most of which will soon be utilised for the production of electricity. A company was established in October, 1911, with a capital of about £5,000,000, held mostly in Canada, England, France and Belgium, for the development of electricity. This company acquired the electric railway between Barcelona and the suburbs of Sarria and Vallvidrera, which will be extended 25 miles, and the 40,000-H.P. plant of the Compania Barcelonesa de Electricidad. The falls of the Ebro River and some waterfalls in the Pyrenees will be used to develop about 120,000 H.P., which will be brought to Barcelona along double electric lines at 85,000 volts. Construction work has already started, and a number of American engineers recently arrived to carry it on. The head of the company is in New York City.

Next in importance in this field is the Energia Eléctrica de Cataluna, established in November, 1911. A third company has been formed under the name of Fuerzas Motrices de Cataluna, by a combination of the Compania Catalana de Gas y Electricidad with an important private firm of Barcelona. This company will utilise the Esera Falls, in the northern part of Huesca Province, and will supply about 30,000 H.P. of electricity to Barcelona.

The Consul considers that there will be excellent opportunities for the supply of the large amount of electrical material for the construction of the hydraulic and steam plants. The factories operated by machinery in Barcelona and its surrounding towns utilise steam to the amount of 180,000 H.P., while the consumption of electricity for lighting in the principal cities is considerable, and is increasing steadily.

United States.—The British Consul at St. Louis reports that with the completion in July, 1913, of the Keokuk dam on the Mississippi River, the expense of the different generating stations will be eliminated, and it is expected that many factories, old and new, will make use of the supply for manufacturing purposes. The current will be carried by six cables on steel towers 75 ft. high and about 800 ft. apart, for which a right of way 100 ft. wide has been bought. It is estimated that 200,000 delivered H.P. can be produced. The Mississippi River Co. which is building the dam and power houses is capitalised at over £5,000,000, and it is hoped to provide power not only to St. Louis, but to Kansas City on the South-West and Chicago on the North-East, as well as to many small towns in the vicinity, and that manufactories will spring up along the line of cables, especially when the added advantage of river transportation will be available. The dam at Keokuk is of solid concrete masonry, and will be 4,700 ft. long in connection with a concrete wall on the Iowa side, with a dry dock and locks. The spillway section of the dam will be 4,400 ft. long, and will carry 116 flood gates to control the water flow. The power house will be 1,400 ft. long, and will contain 30 sets of a rated capacity of 10,000 H.P. each. The present Government locks in the Des Moines Rapids Canal will be replaced at the expense of the company by one large dock and a dry dock, and river navigation will not be interrupted during the construction. The power house, which is of concrete, is 700 ft. × 936 ft., and will contain the wheel chambers and water passages, which will conduct the water to the Francis turbine wheels. The power to be developed is at first 120,000 H.P., of which 60,000 H.P. has been contracted for by the St. Louis Public Utilities under a 99-year contract, contracts to be graduated every ten years according to the price of coal. The lock will be 110 ft. wide × 400 ft. long, with a lift of 40 ft. at low water. The dam contains 119 arch spans, each 36 ft. long, and with an average height of 53 ft. above the bedrock bottom of the channel. Each pier is 6 ft. thick, and 42 ft. wide at the base and 36 ft. at the top. This dam will make a lake of over 1 mile wide and 60 miles long.

A New British Factory for Diesel Engines.—As our readers are already aware, extensive Diesel engine works are being built at Ipswich by the CONSOLIDATED DIESEL ENGINE MANUFACTURERS, LTD., London. This factory will be devoted exclusively to the manufacture of Diesel engines for ship propulsion and for stationary purposes. Situated in a most convenient quarter of the town, with lines from the Great Eastern Railway running direct into the buildings, the new works will be equipped completely with the latest types of machinery and plant. From the inauguration, employment will be given to several hundred workmen; and provision has also been made to secure additional land in order to cope with the increasing demand for Diesel engines. We are informed that all preparations are well in hand, and it is anticipated that the works will be in full swing in the early part of the coming year.

New Works at Runcorn.—A correspondent states that the BRITISH INSULATED & HELSBY CABLES, LTD., are making arrangements for establishing another branch at Runcorn. Some 160 young women belonging to Runcorn travel every day to the Helsby works, where they are employed in processes connected with the manufacture of telephone wire. It is proposed to carry on the work at the branch in Runcorn, and as the company has been in the habit of paying the girls' railway fares, it is estimated that a saving of £500 a year will be effected.

Theatre Installations.—MESSRS. T. W. VAUGHAN AND CO., LTD., of Islington, N., are at present engaged carrying out electrical installations at the following: His Majesty's Theatre, Manchester; Palace Theatre, Westcliff-on-Sea; Electric Theatre, Palmer's Green; Electric Theatre, Canning Town; Princes Hotel Piccadilly; Electric Theatre, Poland Street.

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Private Arrangements.—WALTER STANLEY BRACHER, electrical engineer, &c. (trading as F. & W. Bracher), 65, Redcliff Street, Bristol, and High Street, Malmesbury.—A meeting of the principal creditors of the above was held in London on Tuesday, when a statement of affairs was presented showing the position as at September 19th last. According to this the liabilities expected to rank amounted to £2,517, of which £1,632 was due to trade creditors and £200 to a cash creditor. A sum of £205 was owing in respect of arrears of rent, and there was an overdraft at the bank of £354, while Mr. F. Bracher, a brother of the debtor, was scheduled for £126, the amount due under the agreement for the dissolution of the partnership. There was also a fully-secured creditor for £455, who held securities of the estimated value of £650, or an apparent surplus of £195. Valued on the basis of a going concern, the net assets were returned at £2,008, or a deficiency of £509. On a realisation basis the assets were estimated to produce £1,623, less £101 for preference claims, leaving net assets of £1,522, or a deficiency of £995. It appeared that the business was started in partnership by Messrs. W. S. & F. Bracher, in 1885, both the partners having a capital of £250. The partnership was carried on up till June, 1907, when a dissolution took place. The dissolution was duly gazetted. Accounts were then prepared, and it was agreed that the retiring partner (Mr. F. Bracher) should receive a sum of £350. That debt had never been fully discharged, and Mr. F. Bracher was now a creditor for £126. The branch business at Malmesbury was purchased some time prior to the dissolution of the partnership. It was purchased for £350, but it had been a dead loss, and efforts had been made to dispose of it. The books had not been properly written up, and the usual trading figures could not be presented. In 1908 the turnover of the business was £3,020, while in the following year it increased to £3,986. In the succeeding 12 months the turnover declined to £3,200, but last year it rose to £3,924. Up to September 19th last the turnover during the present year had amounted to £3,750. The wages appeared to have been too heavy for the business, having been at the rate of £2,080 per annum, or £40 weekly, while the drawings of the debtor had been £5 a week. The business had shown gross profits of over £600 per annum. The present position was largely due to the losses which had been made on the Malmesbury business. In that direction over £800 had been lost. The Malmesbury business was being discontinued, and it was believed that the venture could then be made to pay. It was further stated that the debtor wished to continue the business, and he made an offer of a composition of 10s. in the £, payable by four equal quarterly instalments. Owing to suing creditors, a deed of assignment had previously been executed. A resolution was passed confirming the deed already executed, and it was also decided to accept the offer made, provided certain family claims were withdrawn for the time being. A Committee of three of the principal creditors was also elected. The following are creditors :—

Rowe Bros. & Co., Ltd... ..	£310	Sperryn & Co., Ltd.	£36
Hannan, S. J., Ltd.	51	Gardner, Sons & Co., Ltd. ..	27
Coulthurst & Harding	54	Hiller & Crinks	29
Simplex Conduits, Ltd... ..	183	Hall, S. J., & Bros.	44
Henley's Telegraph Works Co.	26	Newtons, Ltd.	21
Walters, E., & Sons	96	Stork & Tidmen	25
Shield, Bush & Co.	86	Veritys, Ltd.	34
Wilmer & Sons	30	Hall, John, & Sons	35

Catalogues and Lists.—MESSRS. A. P. LUNDBERG AND SONS, 477 to 487, Liverpool Road, Islington, London, N.—New "special circular" of 10 pages relating to tumbler switches for the control of heating and cooking appliances. Full details and diagrams of a number of controls are given, and the list is very fully illustrated, both the switches and diagrams being shown. An article dealing with these controls appeared in the ELECTRICAL REVIEW for August 2nd, 1912.

MESSRS. FERRANTI, LTD., Hollinwood.—A collection of illustrated price lists, put together with a neat binding cover, detail the firm's electric heating and cooking apparatus—electric irons, disk stoves, electric ovens and accessories. A loose list fully particularises their time switches, and contains diagrams of connections.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Several new lists in the company's usual form have been issued as follows :—The use of aluminium in the rubber trade, aluminium coach fittings, and torsion joints for aluminium overhead conductors.

THE MIRRLEES-WATSON CO., LTD., Scotland Street, Glasgow.—Catalogue of 16 pages, containing a finely and fully illustrated description of the Mirrlees-Leblanc rotary air-pump in marine work ; also two pamphlets, one of which describes the Mirrlees-Leblanc multi-jet condensing plant, the other similarly dealing with small unit type jet condensers for engines or turbines.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—New catalogue No. 527 (Section II) of about 60 pages, entitled "Automatic Telegraphic Apparatus." Excellently produced illustrations, together with descriptive information and prices, appear, relating to Wheatstone apparatus, station sets, direct motor-driven apparatus, and spare parts. A number of pages are devoted to diagrams of connections and a telegraphic code. Catalogue No. 528, describing electric bells of all kinds, indicators, pushes and other accessories.

MESSRS. DIESEL ENGINE CO., LTD., General Buildings, Aldwych, London, W.C.—Four-page circular drawing attention to the advantages of the Diesel engine for electric generating plants for ship lighting purposes. The necessity for emergency ship lighting has been brought prominently forward by the *Titanic* disaster. The facility of a Diesel plant for being placed in connection with a Marconi wireless installation is pointed out.

MESSRS. HEATHMAN & CO., Parson's Green, Fulham, London, S.W.—A batch of new illustrated lists of telescopic ladders and trestles, fire escapes, hydrants, and other similar lines.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—A 16-page little pamphlet with a green cover, entitled "Lighting News," has been issued as a piece of B.T.-H. publicity literature (No. L (M) 2,297). The style of a "penny weekly paper" in miniature form (4¾ in. × 3½ in.) has been adopted throughout. Notes and brief articles, in small but clear type, and with small illustrations, deal with different aspects of the illumination question. The pamphlet is written mainly for the instruction of the general public, and contractors can have numbers overprinted with their names and addresses for distribution.

MESSRS. WARD & GOLDSTONE, Springfield Lane, Salford.—Price list of "Volex" portable electrical appliances, such as pocket, hand and police lamps, and various novelties.

MESSRS. JOSEPH J. ARMFIELD & CO., Vale of Avon Ironworks, Ringwood, Hants.—Illustrated catalogue showing the "British Empire" turbines for various powers and heads, both vertical and horizontal types, Pelton wheels, regulating gear, pipes, &c., and illustrations of a number of installations carried out by the company.

THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London.—Illustrated leaflet (No. S—3) containing a description, with prices and dimensions, of their new E.A.C. ironclad double-pole switch, all sizes listed being kept in stock.

MESSRS. AUGUST REICHWALD, LTD., Finsbury Pavement House, E.C.—Card showing illustrations of springs made from flat cold rolled band steel.

THE C. W. HUNT CO., West New Brighton, New York.—Catalogue relating to Manila rope for transmission and hoisting purposes, and giving formulæ, tables and data for use in mill engineering.

THE INTERNATIONAL TIME-RECORDING CO., LTD., 151, City Road, London, E.C.—Pamphlet containing copies of letters from satisfied users of the company's automatic time-recording system.

Roumania.—KONSTANTZA.—The projected erection of two pipe lines, each 300 km. long, for the conveyance of raw petroleum and lighting oil respectively from the Prahova petroleum fields to the port of Konstantza, together with the erection of electrically equipped pumping stations at Ploesti and Zandari, will provide opportunities for European and American manufacturers to tender for the machinery and material required. Subject to contingencies, a third pipe line may be subsequently required.

Strong Osrams.—Recently a motor-omnibus collided with a lamp-post in Marylebone Road. The force of the impact was so great that the post broke in two and the lantern was dashed to the ground, smashing all the outer glass to pieces. Nevertheless, the Osram lamps were found to be intact, and when the current was switched on, they lit up with their usual brilliancy, not a bit the worse for the shock. The incident affords a striking testimonial to the strength of Osram drawn-wire lamps.

Office Lighting.—A Committee was specially appointed to determine the best method of lighting the five-storey office building of Messrs. Armour & Co., Chicago, and for this purpose trial installations of the following lighting systems were made :—Direct lighting with prismatic glass reflectors ; semi-indirect lighting ; indirect lighting with porcelain enamel reflectors ; the "eye-rest" system of indirect lighting with X-ray silvered glass reflectors. These installations were given a practical working test over a period of seven months, and the following points were considered before a final decision was made :—First cost ; current consumption ; cost of lamp renewals and labour for cleaning ; and the opinion of the workers. The Committee found that as regards first cost and current consumption, there were only negligible differences between the systems. In respect of the cost of labour for cleaning, the "eye-rest" system of indirect lighting proved decidedly more economical than any of the others. By actual test it was shown that the "eye-rest" fittings and their reflectors could be cleaned in about a third of the time taken for a corresponding installation of direct or semi-indirect units. In regard to the quality of the illumination produced, none of the other systems approached the "eye-rest," which gave diffused illumination, free from "glare" and shadow, and received the unanimous vote of the employés. The Committee decided that by reason of its superior illumination, lower cost of maintenance, and approximately equal first cost and current consumption, compared with other lighting systems, the "eye-rest" system should be employed throughout the offices in question.

Bankruptcy Proceedings. — HENRY HALLIFIELD OXLEY (otherwise known as Oliver Huxley), consulting engineer, 22, Uxbridge Road, Hanwell, Middlesex.—The adjourned public examination of the above-named debtor was held at the Court House, Half Acre, Brentford, last Tuesday week, when the debtor stated that he was now the manager of the British and Foreign Investments Corporation, Ltd., and he was supposed to receive a salary of £500 a year, though he actually received about £6 a week. For the last week or two he had been getting nothing, because he had been away, but he expected to get it when he went back. The Official Receiver : On your preliminary examination you said you were receiving a salary of £500 per annum. Are you prepared to agree to an order setting aside a portion of your salary for the benefit of your creditors ?—Yes. How much will you agree to ?—£100 a year. Questioned as to the expectations he had of being able to pay the debts when he contracted them, the debtor said he had no idea that he was in difficulties until the Official

Receiver pointed it out. He had kept no books of account because he did not consider it necessary. The Official Receiver said that the debtor had not made a full disclosure of his liabilities. Debtor admitted that a Mr. Aken was a creditor for £45 under a promissory note, made on April 24th, 1912. It was made in consideration of "value received," but he denied that he had the money. He owed Aken about £20, and as he (Aken) was in straitened circumstances, the debtor did not wish to keep him without money, and gave him the promissory note to enable him to go to a moneylender. He did not return him as a creditor in his statement of affairs, because he came to him at the time, and said he was hard up. The Official Receiver read a letter of August 15th last, in which debtor wrote to Aken stating that he would be thinking shocking things about his not having replied earlier, and he also read another letter to a man named Forcett, in which the debtor promised to pay £2 until Aken was cleared. Debtor admitted that he had not kept his promise. The debtor said he did not consider it as a legal debt, he was doing it out of friendship. He further admitted that there was another creditor, named George Stone, a cabinet maker, and although he made himself responsible for the whole of the debt, he was not liable, as the debt was only contracted on the understanding that another man paid his full share. The Official Receiver said he must have further information about the furniture, and therefore ordered the case to stand adjourned.

A. P. Parker, electrical engineer, 8, Mary Street, Burnley.—October 4th is the last day for the receipt of proofs for dividend. Trustee: Mr. C. H. Plant, 13, Winckley Street, Preston.

Dissolutions and Liquidations.—District Electric Co., Ltd.—This company is winding up voluntarily, with Mr. J. W. Hinks, 115, Colmore Row, Birmingham, as liquidator.

Kjellberg Syndicate, Ltd.—This syndicate is winding up voluntarily, with Mr. J. B. Hamilton, 15, Little Trinity Lane, E.C., as liquidator.

Bohm Lens Lamp Co., Ltd.—A meeting is called for October 26th at 15, Great St. Helens, London, E.C., to hear an account of the winding-up from the liquidator, Mr. E. S. Neave.

Book Notices.—*Canada for the Investor and the Industrious Millions of Great Britain.* By T. W. Sheffield. Bristol: J. W Arrowsmith, Ltd. 1s. net.—The author of this little book, from his experience in this country, followed by some years' life in Canada—for part of the time as an industrial commissioner for Regina—should be able to interest those in need of information regarding Canadian resources and opportunities. He has combined the information gained as the result of personal observation with material obtained from Government departments, the Board of Trade, the Press, and so on. After a brief opening chapter, in which, among other things, the author refers to the apathy of British manufacturers and merchants, he deals with different parts of the vast territory in geographical order, and reproduces a number of interesting photographs. Mr. Sheffield's idea has been to bring out the main features of the places mentioned in so far as they are likely to be of interest to his fellow countrymen at home. It is impossible either for the trader or the worker nowadays not to be impressed with the coming greatness of Canada, but it would doubtless be useful to any of our readers who are casting eyes that way if they made a study of this little book.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 9. September, 1912. New York: The Institute. Price $1.00.

"*Transactions* of the Concrete Institute." Vol. IV, part 2. July, 1912. London: The Institute.

"*Prospectus* of the Borough Polytechnic Institute, 1912-1913." London: The Institute.

"How to Manage the Dynamo." By A. R. Bottone. London: Whittaker & Co. Price 9d. net.

"Engineering and Metallurgical Books, 1907-1911." By R. A. Peddie. London: Grafton & Co. Price 7s. 6d. net.

"La Tecnica delle Correnti Alternate." Vol I. By Ing. G. Sartori. 1913. Milan: Ulrico Hoepli. L. 12.

"Statistik über Starkstromanlagen Allgemeiner Teil Zentralanlagen Kategorie A pro 1910." "Jahresheft des Schweizerischen Elektrotechnischen Vereins für das Vereinsjahr, 1911-1912." 1912. Zurich: Fachschriften-Verlag und Buchdruckerei A.-G.

Shipwrecked Lamps.—The British Thomson-Houston Co., Ltd., inform us that salvage operations on the sunken P. and O. liner *Oceana* resulted in the recovery, amongst other things, of cases containing 600 Mazda lamps. On examination, it was found that, of 500 25-watt 100-volt lamps, 22, or 4·4 per cent., were broken, and of 100 25-watt 55-volt lamps, only two, or 2 per cent., were broken. The remainder were returned to Rugby in perfect condition. Considering the rough treatment which the lamp cases must have received, the proportion of breakage is remarkably small.

Trade Announcements.—Messrs. Siemens Brothers Dynamo Works, Ltd., of Dalston, inform us that under the new Post Office system their registered telegraphic address is "Siemodyn, Kinland, London." The indicator word "Kinland" will not be charged for.

The Emanda Engineering Co., Ltd., owing to the rapid growth of their business in switch, distribution and fuseboards, switch boxes, &c., have removed to Emanda Works, Sumner Avenue, Peckham, London, S.E. A leaflet which they have issued illustrates some of their manufactures.

Mr. John T. Murray, electrical engineer and contractor, of Halifax, has removed from Rawson Street to 3, Lord Street.

With reference to our notice regarding the affairs of Mr. A. E. Martin, trading as the Midland Electric Supply Co., 39, Great Charles Street, Birmingham, we are asked to point out that the Electrical Trades Supply, Ltd., also of Great Charles Street, is in no way connected with the Midland Electric Supply Co., and has never been in any sense associated with the latter firm.

Mr. Stephen Workman, electrical engineer, of Updown Hill, Windlesham, near Bagshot, announces that he is relinquishing business.

Messrs. Safety Light, Ltd., have removed to 118, Queen Victoria Street, London, E.C.

The Edison and Swan United Electric Light Co., Ltd., have opened a depôt in Bristol (at 71, Victoria Street), with Mr. F. W. Fifield as district superintendent, for the convenience of their West of England customers. Large stocks of their metal-filament lamps will be carried.

"Robbialac."—At the Tramway Exhibition at West Ham, a tramcar of the West Ham Corporation was on view which had been treated with Robbialac enamel paint supplied by Messrs. Jensen & Nicholson, Ltd., Goswell Works, Stratford, E. This paint is widely used by tramway and railway authorities. The firm had on show at their stand their ultra-high-resistance insulating composition, "Wattlac," for which they claim an actual breakdown strength of 28,000 volts per mm. A selection of metal underbody parts was also shown, treated with their anti-rust and corrosion-proof composition, "Ferroradium."

Newcastle Electrical Exhibition.—Messrs. Berry, Skinner & Co. inform us that their fool-proof ironclad fused switchgear has been employed at the above exhibition on the main switchboard, and for controlling the lighting of the entrance and the electric sign, the Provincial Laundry, cookery exhibits, electric water heating and the café.

The Shops Act.—Morecambe Corporation has made a closing order under the provisions of the Shops Act for the retail electrical trades in the town. The closing day is Wednesday. Morecambe, of course, takes advantage of the privilege extended to seaside holiday resorts of disregarding the order in the summer months.

Silica Lamps.—Messrs. Ashworth & Parker, of Bury, have decided on the adoption of Silica lamps for the lighting of their recently-completed extensions. The electric lighting and power installation for Messrs. Tatham & Co.'s new works at Rochdale is in the hands of the Rochdale Electric Co., and the premises here are also being lighted throughout with Silica lamps. These lamps have further been adopted for the surface lighting of the Alloa Coal Co., Bannockburn Colliery, Stirlingshire.

LIGHTING and POWER NOTES.

Aylesbury.—The U.D.C. has appointed four persons outside the Council to act with a Committee to consider a scheme for electric lighting for the town under the newly-obtained provisional order.

Baildon.—The U.D.C. has decided to ask the Bradford T.C. to agree to one of the following alternatives in connection with the proposed tramways:—To supply current to Baildon in bulk: to pay 1¾d. per unit if the electricity is supplied by Shipley; or to find its own current for running the Baildon tramcars. Shipley U.D.C. has offered to supply current at 1¾d. per unit, but preferred the supply to be obtained elsewhere if possible.

Barking.—A letter has been received from the L.G.B. with reference to the Council's application for sanction to a loan of £11,200 for the purpose of extensions to the electricity works, stating that the Board was not satisfied that the scheme submitted was the most suitable for the purposes of the Council's undertaking, and that it was not prepared to sanction the loan. In consequence of this decision the Committee has decided to submit an amended application to the Board for approval involving an expenditure of £8,335, made up as follows:—Diesel engine and D.C. generator 250 kw., £4,000; foundations, £240; rotary converter, £800; switchgear, £260; steam recorder, &c., £105; connections (cable, &c.), £140; tools and spares, £150; boiler feed pump and connections, £180; rearranging position of present plant, £60; clerk of works, £75; contingencies, £250; loan costs, £75; mains and services, £2,000. It has also directed the engineer to prepare specifications, &c., and to invite tenders for the supply and erection of the necessary plant. With regard to the tenders which were provisionally accepted for the original scheme, the firms are to be notified of the L.G.B.'s decision.

Barnsley.—The Yorkshire Electric Power Co. is proposing to erect a waste heat station for the generation of electricity from coke-oven gas at Barugh, near Barnsley, and at the half-yearly meeting of the company, it was suggested that an extra £50,000 of preference capital should be raised, and that £25,000 of this should be devoted to the new work. Last year's profit had decreased by £800 as compared with 1911, but was £810 in advance of that of 1910. The new station was very necessary, as there had been an increase of 20 per cent. in the amount of electricity sold from the power station.

Belfast.—At the meeting of the Tramways and Electrical Committee, the electrical engineer submitted his reports on the question of installing Diesel engines in connection with the proposed extension of the electricity undertaking and as to the establishment of sub-stations.

Blackburn.—The Electricity Committee has under consideration a report by Mr. Wheelwright, the borough electrical engineer, on the question of new works for the electricity department.

Cleckheaton.—The District Council reports a net loss of £406 on the last year's working of the electricity undertaking. This is mainly due to the increase in cost of generation, coal and repairs and maintenance of works. *Per contra*, the price of current has been more satisfactory to the Council, and the number of units generated has increased from 908,044 to 1,159,272. The increase in the cost of generation has been met by the transfer of a small balance from the reserve fund and £347 from the general district fund.

Continental Notes.—Denmark.—A company is reported to be in course of formation to establish a large electricity generating station near Kerise, in South-East Seeland, for the supply of current for lighting and power purposes to a number of small towns and villages in the district.

East Barnet Valley.—At the last meeting of the District Council, Councillor Ford moved: "That the North Metropolitan Electric Power Co. be asked if it will be possible to lay their main cables throughout the district of the Council by October, 1913, and, if so, at what cost they would be prepared to light the public roads." He stated that there was a great demand for electricity for lighting and power purposes throughout the district. He was prepared to go any length to encourage the electrical company, if it were only to break down the monopoly of the Gas Co. in the district. It was a disgrace to pay money to have the district lighted when the result was practically semi-darkness. After further discussion bearing upon the extremely bad lighting by the Gas Co., the motion was carried *nem. con.*, and a committee was appointed to go into details.

Edinburgh.—At a meeting of the Treasurer's Committee of the T.C. on Friday last, Councillor Harrison moved that the electric lighting surplus be applied to the relief of rates, and this motion was carried against a proposal by Councillor Bruce Lindsay, that the Committee recommend that the surplus be not appropriated. This recommendation will now come before the Town Council.

Epsom.—The U.D.C. has received from the L.G.B. sanction to a loan of £2,800 for additional generating plant and £500 for mains.

Glasgow.—The minutes of the Electricity Committee of the T.C. contain a report by the engineer that Messrs. Harland and Wolff had applied to the burgh of Govan for a supply of electrical energy for their ship-building yard in Govan. The supply, which would be of large extent, would be required in a few months, and it would be necessary to connect the Corporation's system of distribution with that of Govan to enable it to be given. The town clerk reported that as a result of meetings of the sub-committee on the Boundaries Act with representatives of the burghs of Govan and Partick, the T.Cs. of the latter towns agreed to the connection of their electricity undertakings with that of the Corporation, and that the Corporation Electricity Department should supply the current required. The engineer was authorised by the Committee to have the proposed connection made.

Helsby.—The P.C. has decided to canvass the district in order to ascertain the probable number of consumers of electricity for domestic purposes. The information is needed by the Mersey Power Co. before it can quote for public lighting.

Ilford.—A serious fire occurred on Tuesday afternoon at the electricity works of the U.D.C., causing a complete stoppage of the supply and of the local tramway service. The origin of the fire was behind the main switchboard, where the flames broke out suddenly with great violence, and at once ignited the roof. The fire brigade was quickly on the spot, but it took an hour's work to subdue the flames, and then all but one of the dynamos were soaked with water. A part of the tramway service was re-started with power from East Ham, but various large works supplied from the Ilford power station were shut down. The supply was partially resumed by 8.30 p.m.

Leeds.—A proposal of the Corporation to establish a department for the hiring-out of electric motors is meeting with strong opposition on the part of local electrical firms. The Corporation proposes to borrow £10,000 for the purpose, and the opposition asserts that not only is it unfair to institute this municipal competition with private traders, but it would be impossible for the Corporation, with the suggested outlay, to provide a service anything like equal to that which would be displaced, and also that the authorities, in their limitations as to stocking varieties of types and parts, would run the risk of wasteful speculation on makes of motors which might become obsolete at an early date, or prove useless under a changed system of supply. The opposition includes practically all the local firms, and an influential deputation recently waited upon the Tramways and Electricity sub-Committee and entered a protest. A deputation is also to attend the next meeting of the City Council.

Llandudno.—In a statement as to the progress of the Corporation electricity undertaking, at the meeting of the T.C. on September 20th, Mr. S. Chautrey (chairman of the Electricity Committee), said that the year ending March 31st last was the first following the installation of a coal conveyor and an induced draught system. The induced draught apparatus was a step of a speculative nature, but it had proved a great success. Not only had it stopped the emission of smoke, but it enabled mechanical stokers to be employed, with a resultant saving of £1,112 in fuel. The year's trading resulted in a net surplus, after paying interest and redemption on loans, of £884, and this notwithstanding that the price of current had been reduced by ½d. per unit. Unfortunately, there had been a decrease in the supply of current to the tramways company, but now that the track was doubled for a considerable distance, the probability was that the current year would show better results, and that the traction consumption would steadily increase.

London.—Bethnal Green.—In connection with the Electricity Committee's recommendation, reported in last week's issue, advising the Council to adopt its suggestions with regard to the taking of a supply of electricity from Stepney, the matter was again referred back to the Committee, at the meeting of the Council last week. At this meeting a letter was read from the town clerk of Stepney to the effect that after consulting the borough electrical engineer and treasurer he was of opinion that his Council would be prepared to undertake the maintenance and administration of the electrical supply in Bethnal Green upon the basis of the following proposals:—For repairs and maintenance of mains, house services, meters and other apparatus on consumers' premises, maintaining and supervising sub-station plant, reading meters monthly, rendering a monthly statement to the Bethnal Green treasurer with all information necessary to enable him to render and collect consumers' accounts, establishment charges and management expenses, a charge of 0·2d. per unit for each unit sold in excess of a certain quantity which was not mentioned publicly at the meeting. Capital work (if any) on plant, mains, house services, &c., executed by Stepney for Bethnal Green to be charged for on cost basis plus 10 per cent. for use of tools, &c., establishment charges and supervision. Such proposals are subject to confirmation by the Stepney Council. A letter was also read from Mr. J. F. C. Snell, the Council's consulting electrical engineer on the subject of the above letter. In this letter Mr. Snell stated that he considered the terms offered to be very favourable indeed to the Bethnal Green Council. The figures quoted result in less annual charges than he had included in his estimates. He was of opinion that there could be no chance of the Council losing on the undertaking, but that, on the other hand, it would be a source of considerable profit, apart from the great convenience to the ratepayers of the borough. In the discussion which followed the motion for the adoption of the Committee's report, Councillor Brookes, whilst holding to the principle of electricity supply, urged that it would not be right for the Council to come to a decision that night without the Committee having had an opportunity of considering the letter from Stepney, which bore the previous day's date, and had been received only that day, and therefore had not been under the consideration of the Committee, and moved that the whole matter be referred back to the Committee for consideration. He was opposed to the present Council, at the last meeting but one before the elections, pledging its successors to a great expenditure of £21,000. As stated above, Councillor Brookes's amendment was adopted by 13 votes to 12.

Fulham.—The Electricity Committee reports the receipt of a communication from H.M. Electrical Inspector of Factories upon the Council's electricity works, stating that many things were not in accordance with the requirements of the Electricity Regulations under the Factory and Workshop Act, and suggesting alterations. The Inspector's report, the Committee states, has received the consideration of the borough electrical engineer, and the less important matters are being attended to. The only suggestion involving serious alteration is in connection with the high-tension switchboard, which, to meet the requirements of the Regulations, will have to be remodelled and reconstructed. The electrical engineer is to at once issue to a number of experienced firms a general outline of the essential requirements, and invite each of them to prepare and submit for consideration a complete scheme, together with an estimate of the cost of carrying out the proposals.

Lowestoft.—The T.C. has fixed a flat rate of 1d. per unit for current for cooking and heating, and has decided to expend £100 on cooking and heating stoves and electric irons for hiring out. The charges for current for power supplied to factories and workshops have been reduced to 2d. per unit for the first 500 units per quarter, and 1½d. per unit beyond.

Quarndon.—The P.C. has appointed a Committee to consider the advisability of adopting electricity for public lighting. The Committee will confer with the Derby Borough electrical engineer, Mr. Wilmshurst, who has already outlined a scheme.

Rochford.—After protracted discussion, the B. of G. has, by 14 votes to 8, adopted a scheme for lighting the Workhouse by electricity in place of gas. With the heating scheme the expenditure is estimated at £6,320. The matter, however, will again come forward, as notice has been given to rescind the adoption of the scheme, on the ground that it is too expensive for a building of the size of the Workhouse. At present gas is supplied at 3s. 9d. per 1,000 cb. ft., and the consulting engineer, Mr. Dolby, had advised that electricity will be cheaper than gas.

Sevenoaks.—Mr. Cecil E. Currie, who is applying for a prov. order for E.L., has informed the R.D.C. that the whole of the parishes in the Council's area will be included in the application.

South Africa.—At a special meeting of the Wellington (Cape Province) municipal Council, at which representatives of the public were present, it was decided to provide an electric lighting installation for the town. Two schemes were submitted, but some further information is required before the project can be taken in hand and the plant erected. The installation will supply a long-felt want, especially in the many boarding establishments.

We understand that an agreement has been arrived at between the Wynberg Council and the Cape Town Council for the purchase by the former of the electricity distributing system and the various rights acquired in Wynberg by the City as the result of its purchase of the undertaking of the Cape Peninsula Lighting Co. The agreement is of the nature of a compromise, the purchase price being fixed at £8,060.

Southend-on-Sea.—The T.C. has applied to the L.G.B. for a loan of £3,900 for an additional 500-KW. steam generating set, for which tenders are to be invited. The L.G.B. has also been asked to allow the expenditure of an unexpended loan, amounting to £3,745, granted for cables, on ordinary extensions.

Southport.—The report of Mr. S. J. Watson, of Bury, who was called in as an expert to investigate the electricity undertaking, was presented to the Corporation on Saturday. A report upon the tramways is to be furnished at a later stage by Mr. Mallins, of Liverpool. The outstanding feature of the electricity report is the financial position, dealing with which Mr. Watson says that the undertaking is over-capitalised. The capital expenditure of £110,577 on the generating station is equal to £45 per KW. installed. In many other undertakings of similar size the expenditure is only £25 per KW., and at prices that obtain to-day equivalent value could be obtained at £15 to £18 per KW. The expenditure of £75,854 on mains, services and arc lamps is also excessive for an undertaking of its size, even after making allowances for the special character of the district and the class of customer supplied. The £20,811 expended on transformers and meters is out of all proportion to the actual value of the appliances which the sum is supposed to represent. No provision has been made for depreciation or for the replacement of plant or apparatus. A casual inspection shows that the useful life of much of the plant and appliances must be considerably less than the period granted for the repayment of the loans. Although no reserve or depreciation fund has been established during the past 14 years, the sum of £27,000 has been transferred from the revenues of the undertaking to the relief of the rates. "At the present time, therefore," the report proceeds, "there exists what amounts to a liability on the ratepayers for about £20,000 for depreciation in the value of the assets of the electricity department." Mr. Watson suggests that no further contributions whatever should be made to the rates until an adequate reserve or depreciation fund has been established.

Mr. A. S. Black (borough electrical engineer and tramways manager) commenting on this report, makes a remarkable suggestion. Before additional expenditure on tramway plant is decided upon, he thinks the whole question of the tramways should be considered. The whole of the Corporation tramways track will have to be renewed before long, and he suggests that it would be more satisfactory to abolish the present system, and substitute a petrol or petrol-electric service of motor-cars.

The report will be discussed at the next meeting of the Council.

Wellingborough.—The U.D.C. has decided to make no offer for the undertaking of the Electric Supply Co. until it has been inspected by an expert, and that it would not be worth the expense of expert advice unless the company reduces its offer to about two-thirds the sum recently named, and published at the time in the ELECTRICAL REVIEW.

West Ham.—Application is to be made to the Local Government Board for sanction to borrow £7,600 for transformers, and £6,000 for services. The B. of T. is to be asked to give its consent enabling the Council to give a supply of current to Messrs. Pearson, the contractors for the Port of London Authority Docks' extensions, for consumption outside the area of West Ham. An agreement has been entered into with the Charing Cross Supply Co., enabling it to continue for a further period of three years to take from the Council a supply of current at the Bow generating station. The India-Rubber, Gutta-Percha and Telegraph Co., Ltd., has signed an agreement with the Council for taking a supply of about 2½ to 3 million units per annum, at 450 to 600 KW. maximum demand.

Weymouth.—The L.G.B. has forwarded to the T.C. sanction to a loan of £3,880 for generating plant, £700 for extensions of buildings, £800 for mains, and £1,700 for services.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—On the recommendation of the Tramways Committee last week, it was decided to specially adapt six cars as an experiment, to the P-A-Y-E system, in connection with the Corporation Tramways, and to make supplication to the B. of T. for sanction to introduce a front entrance on cars for the upper deck passengers.

Blackpool.—An innovation was introduced on the tramways last week. By arrangements with the Postmaster-General, letter boxes are now attached to certain cars on each of the four routes, thus enabling the public in the outlying portions to post letters after ordinary collections from pillar boxes and sub-offices, and avoid a special journey to the central office. Letters may be posted at any stopping place, but if a car is stopped expressly for the purpose of posting only, a charge of 1d. is made to remunerate the Corporation.

The Corporation has under consideration a further scheme for extending the promenade at South Shore to Squire's Gate. The proposal which provides for the construction of a tramway track and carriageway is estimated to cost £48,000.

Broughton.—The Wrexham and District Electric Tramway Co. has informed the P.C. that it cannot at present consider the project for extending the tramway through New Broughton, Brynteg and Pentre Broughton, as such an extension would not justify the expenditure.

Canada.—In connection with its line to Vancouver, B.C., the Canadian Northern Railway is to enter the city by means of a four-mile tunnel, and in connection with this about 18 miles of route between Vancouver, New Westminster and Port Mann will be electrified.

Continental Notes.—RUSSIA.—The shares of the Société des Tramways de Reval, which owns the horse tramway system in the Russian port of Reval, have all been acquired by the Société Generale Tramways et d'Applications d'Electricité, of Liége, who propose to electrify the lines.

Dundee.—The railless electric car system inaugurated recently by the Corporation has been inspected by Mr. A. Campbell, city engineer, Edinburgh, and Mr. Laidlaw, a director of the Edinburgh Tramway Co. Mr. G. M. Stuart, chief city engineer, Bloemfontein (who is studying the various systems with a view to establishing a tramway system 12 miles in extent in Bloemfontein), and Mr. Donald M'Coll, manager of the Shanghai tramways, have also visited the town.

Edinburgh.—In connection with the scheme for extending the tramways, the sub-committee on new tramways, with the burgh engineer, has been requested to report on the three systems—railless, self-propelled cars, and motor-omnibuses—giving at the same time particulars as to cost.

Halifax.—In connection with the Bill which the Corporation is promoting for tramway extensions, it has been decided to take tramways to Wainstalls and Siddal, outlying portions of the borough.

Keighley.—The fate of the motor-'buses, which, in conjunction with the Corporation tramways, serve the out districts of Keighley, hangs in the balance. The controversy which has for some time past waged around the fact that they have not directly paid their way, was brought nearer to a head last week, when, at the T.C. meeting, Alderman King moved the entire discontinuance of the service, but admitting the fact that they undoubtedly acted as useful feeders for the tramways in the rough, hilly parts to which electric trams had not access, that they brought outside trade into the town, and that changes in the department were promised by the Committee concerned, he also moved that consideration of his motion be deferred for a month. This latter was carried, despite an amendment to the contrary.

Lancashire and Yorkshire Electrification.—The Lancashire and Yorkshire Railway Co. are about to commence the electrification of the system from Town Green to Ormskirk. The old rails are being replaced, and in the course of another month a start is to be made with the construction of buildings for an electric sub-station and battery station at Ormskirk. The company, encouraged by the success of the electrified system in the Liverpool district, feels confident that the consequent improved train service will in time more than compensate for the outlay. It is expected that as a result of the immediate start in connection with the extension, building developments on an appreciable scale will follow.

Llandudno.—The Light Railway Co. having announced a desire to double the track in certain parts of the district, a Committee of the local D.C. has been appointed to meet the representatives of the company to discuss the project.

Mytholmroyd.—The D.C. has expressed its willingness to enter into an agreement with the Halifax Corporation, provided the terms are acceptable to both parties, whereby it is proposed to postpone the Council's powers under Sec. 43 of the Tramways Act, 1870, to acquire the tramways now worked by the Corporation within that district, until the expiration of 31 years from the date of the Royal Assent to the Halifax Corporation's (proposed) Tramway Bill.

Newcastle-on-Tyne.—The Tramways Committee has referred to a Sub-Committee a scheme for reconstructing the bogie cars at an estimated expenditure of £10,000.

Oswaldtwistle.—At the Council meeting on September 19th, Mr. Hargreaves again referred to the rating of the tramways, and the action of Accrington Corporation in deducting three-quarters of the rate. Criticising figures given by Councillor J. C. Lupton, of Accrington, Mr. Hargreaves said it was one of those cases where they could make figures prove anything. He did not question the legality of the action taken by

Accrington in making deductions from the rates, but contended that the reduction was a violation of the ordinary principles of equity. The minutes showed the receipt of a letter from the general manager of Blackburn Corporation asking for the return of a portion of the rate paid by the Corporation respecting its undertaking in the Oswaldtwistle area. The matter was left over until a decision had been given in the appeal case affecting tramway rating.

Soyland.—The D.C. has decided in favour of the extension of the Halifax tramways to Ripponden, on terms to be arranged between the Council and the Halifax Corporation.

U.S.A.—With a view to the more rapid advancement of the electric motor vehicle in the New York district, the New York Electric Vehicle Association has just been organised in that city. It is stated that there are at the present time no fewer than 400 electrical vehicles of the pleasure type in use in New York, in addition to 1,400 industrial vehicles.

Wharfedale.—At the Otley R.D.C. on Friday, a deputation representing the Leeds Corporation Tramways Committee was heard as to the running of railless cars from Guiseley to Otley, and an extension of the service through Burley to Ilkley. Mr. Jackson (chairman of the R.D.C.) said it was a question that would require serious consideration. Mr. Redshaw pointed out that they would do a great service to the public, as at present the railway company had a monopoly and could run a train when they liked. The chairman said the ratepayers might be helping the City Corporation, which had a monopoly as well. Ultimately the matter was referred to the Menston Parish Council, which was interested in the proposal.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Commonwealth Budget Estimates for 1912-13 include provision for the expenditure of £789,000 for telegraphs and telephones, and £41,000 for wireless telegraph installations.—*Board of Trade Journal.*

Brazil.—The Government intends to extend the wireless telegraph system in the Northern part of Brazil. The three stations now existing at Para, Manaos and Santarem are to be supplemented by five others, of which three are now completed, whilst the other two are being built. Two of the stations, those at Cruzeiro do Sul and Senna Madureira, will be high-powered ones, whilst the one at Rio Branco will only have a quarter of the power of the two former. The distance between Cruzeiro do Sul and Senna Madureira is 450 km., and between Senna Madureira and Rio Branco 156 km. It will be possible to get into communication across the Andes with Cristobal, near Lima, and Iquitos, from the stations at Cruzeiro and Senna Madureira, though the distances range from 500 to 1,000 km.

Cable Rates.—The Western Union Telegraph Co. is now taking Press messages for Australia *viâ* the Pacific Cable at 7½d. per word for ordinary and 4½d. per word for deferred messages.

France.—A wireless telegraph station with a transmitting power of only 250 miles is to be erected at Harfleur, near Cherbourg, for the exclusive use of the French naval authorities when communicating from the shore with vessels of the fleet in the Channel. This step has been taken because it has been found that serious danger might arise in war from the use of the big wireless station at Rouges-Terres, for the communications between the staff of the First Maritime District and the stations along the coast or the ships in the Channel, as, owing to the powerful transmitting apparatus at Rouges-Terres, the messages sent by its agency might easily be tapped by foreign ships cruising in the Atlantic or North Sea.—*Daily News.*

New Companies.—A new joint-stock company is being constituted by the Hochfrequenzmaschine-fabrik für Drahtlose Telegraphie, of Berlin, which will undertake the international working of the Goldschmidt high-frequency patents. German, French and American capital and industries will share in the venture. The capital proposed is 10,000,000 fr., 25 per cent. of which will be called up. The new company will start operations with the erection of a trial system between Germany and America, for which a tower is to be built near New York and another in Hanover by the German company.—*Zeit. des Oest. Ing. & Architekten-Vereines.*

Secret Wireless Telegraphy.—It is reported that a trial is to be made in the Channel of a system of tuned wireless telegraphy devised by Messrs. Johnson and Varley, depending upon the use of accurately tuned vibrating reeds.

United States.—The Government is about to institute proceedings for the dissolution of the American (Bell) Telephone and Telegraph Co., which is alleged to have violated the Anti-Trust Act, and to have maintained a virtual monopoly in telephony by absorbing independent companies in all parts of the country. The company has a capital of about 100 millions sterling.

Telegraph Rates.—On October 1st the Eastern Telegraph Co. will reduce the Press rates between Great Britain and India and Burma, from 9d. to 4d., between Great Britain and Ceylon, from 9½d. to 4½d., and between Great Britain and British North Borneo, from 1s. 8d. to 6d. a word.

Wireless in the Antarctic.—The *Australian Mining Standard* states that the wireless installation on Macquarie Island, in the Southern Ocean, has shown how favourable surroundings enable enormous distances to be covered by an ordinary ship's set, which is able to pick up messages from Fremantle and repeat them to Fiji. A ship, as a rule, can only get messages from 200 or 300 miles away, but there in the long stretches of ocean and the absence of disturbing meteorological conditions they deal with far greater distances. The station is also used as a "repeat station" to New Zealand. The wireless plant which Dr. Mawson carried with him to the Antarctic, in the hope that by means of the installation at Macquarie Island it would be possible to keep in constant touch with the expedition, unfortunately was smashed before it had been erected, through falling off a crag of ice, and the wireless operator and mechanician were unable to repair it.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—October 16th. N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, 61, Hunter Street, Sydney.

South Australia.—October 22nd. Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" September 13th.

October 23rd.—100 common-battery table telephones, for the P.M.G.'s Department. See "Official Notices" September 13th.

December 17th. Three sections of common battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" September 13th.

November 12th.—Deputy P.M.G., Melbourne. 100 electrical registers. High Commissioner's Office in London.

November 19th.—One mercury vapour condenser, for the P.M.G.'s Department. See "Official Notices" to-day. Also two batteries, and a 4-K.V.A. single-phase transformer. High Commissioner in London.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—Vienna.—October 24th. Electric installation in the workshops and material warehouse at Gmünd. Particulars of the Bahndirection, Gmünd.

October 4th.—The Austrian State Railway authorities at Linz are inviting tenders for an installation of electric lighting at the railway station at Ried.

Belgium.—October 1st. Tenders are being invited by the municipal authorities of Montegnée (province of Liége) for the concession for the supply of electrical energy for lighting and power purposes in the town.

Crete.—The municipal authorities of Candia, in the Island of Crete, have lately invited tenders for the concession for the electric lighting of the town during a period of 40 years.

France.—October 15th. The French State Railway authorities in Paris are inviting tenders for an installation of electric lighting at the railway station at La Pallice. Tenders are to be sent to, and particulars may be obtained from, Le Service Electrique des Chemins de Fer de l'Etat, Rue de Rome, Paris.

Paris.—October 4th. Tenders are required for the installation of the electric light at Evreux railway station. Particulars from the Bureaux du Service Electrique (1st division), 40, Rue de Rome, Paris.

Paris.—October 17th. Offers will be received, in two lots, for (1) the supply and erection of the motors, pumps and dynamos needed to raise the water of the Seine for the high-service supply at Auteuil and Passy, and for the low-service of the Bois de Boulogne and the XVIth Arrondissement; (2) dynamos, motors and centrifugal pumps, to lift the sewage water of the XVth Arrondissement to the collector on the right bank of the Seine. Particulars, Bureau des Eaux, Canaux, et Egouts, Hôtel de Ville.

Great Western Railway.—October 14th. Stores for a year. See "Official Notices" to-day.

Greenock.—October 2nd. Electric lighting work at Finnart School. Mr. A. F. Niven, clerk to the School Board, Municipal Buildings. (Schedules, £1.)

Isle of Thanet.—General stores for a year, for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" September 20th.

Leeds.—October 7th. The Tramways Committee of the Corporation invites tenders for the supply and erection of a steel building at the permanent way depôt, Leeds. Mr. J. B. Hamilton, general manager.

London. — SOUTHWARK. — October 2nd. 440 yd. or 880 yd. of ·1 × ·05 × 1, and 440 yd. or 880 yd. of ·05 × ·03 × ·05 cable, for the B.C. See "Official Notices" September 20th.

Lossiemouth.—September 28th. Gas producer plant, engines and dynamos, battery, crane, overhead mains and public lamps, for the T.C. See "Official Notices" September 6th.

Manchester. — October 1st. Permanent way points, tongues, and hardened steel centres, for the Tramways Committee. Specifications and forms of tender (£1 1s. returnable) from Mr. J. M. McElroy, general manager.

Mersey.—October 4th. The Mersey Railway Co. are inviting tenders for electrical and other stores. Specifications and forms of tender from Mr. J. Shaw, engineer and manager, Central Station, Birkenhead.

Mexborough. — October 5th. Turbo-generator, condenser and switchgear, for the U.D.C. See "Official Notices" September 13th.

Nuneaton.—September 30th. Cast-iron and steel pipework, valves and accessories, for the Corporation. See "Official Notices" September 20th.

Rosslynlee.—The Midlothian and Peebles District Asylum, Rosslynlee, invite offers for supplying electric fittings. Mr. R. Addison Smith, 19, Heriot Row, Edinburgh.

Spain.—October 4th. The municipal authorities of Puebla de Guzman (province of Huelva) are inviting tenders for the concession for the electric lighting of the town during a period of 20 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Puebla de Guzman (Huelva).

November 9th. The Spanish Ministerio de Fomento, in Madrid, are inviting tenders for the concession for the construction and working of electric tramways between Vigo and Lavadores, and between Vigo and Arratales. It may be added that a project has, in each case, been submitted by a would-be concessionaire, the concession being only put up for tender in accordance with the practice in Spain.

Tenders have just been invited by the municipal authorities of Boadilla del Camino (province of Palencia) for the concession for the electric lighting of the town during a period of eight years.

Sweden. — October 15th. Tenders are invited for machinery required at the Porjus Power Works, viz:—(1) Electric lift for passenger and goods; (2) two electrically-driven oil pumps; and (3) three electrically-driven water pumps. For further particulars see this column last week.

Watford.—September 30th. The U.D.C. is inviting tenders for one electrically-driven pumping plant. Specifications and forms of tender (£2 returnable) from Mr. D. Waterhouse, Engineer and Surveyor, Watford.

October 15th.—One 500-KW. steam alternator and a switchboard machine panel for the U.D.C. See "Official Notices" to-day.

CLOSED.

Aberdare.—Messrs. Clough, Smith & Co., Ltd., have secured from Messrs. Wm. Griffiths & Co., Ltd., contractors for the complete tramway and railless systems for the U.D.C., the following sections:—Overhead line equipment, tramways; overhead line equipment, railless; overhead feeder cables and underground mains.

Australia.—"The question of the extent of preference to local manufacturers had to be decided by the Minister for Home Affairs in connection with the power plant to be erected at the Federal capital site. Messrs. Thompson & Co. offered to carry out the work on a 10 per cent. basis, but presumably the Minister desired a straight-out quotation, and it is understood the local manufacturers' price was £5,000 higher than that of the British manufacturers. The Minister has now practically approved of the following tenders:—Boiler house plant, Babcock and Wilcox, Ltd., £5,706; engine room plant, Price & Martyn (Bellis and Morcom), £3,816; alternator and electrical exciter, Gilbert Lodge & Co. (Brush Electrical Engineering Co.), £1,204—total, £10,756."—*Tenders (Mining and Engineering Review)*

Ayr.—The tender of Messrs. Bruce Peebles & Co. has been accepted by the T.C., at £525, for the supply of a motor-generator.

Barnsley.—The T.C. has accepted the tender of Messrs. Turner Bros., of Barnsley, for 3,000 tons of Hickleton main slack coal for the electricity works.

Burslem.—The Governors of Haywood Hospital have accepted the tender of Messrs. W. Wadsworth & Sons for the provision of an electric lift.

Canterbury.—The B.G. has accepted the tender of the A.E.G. Co., of Canterbury, for electrical work for six months.

Continental.—For supply and erection of electrical equipment of transformer sub-stations at Dieghem, the following tenders were submitted:—

(A) Ateliers de Charleroi, 106,760 fr. and 118,500 fr.
A.E.G., Brussels, 121,176 fr. and 148,800 fr.
Siemens-Schukert, 138,500 fr.
Anglo Belge, 165,000 fr.
Vedovelli & Priestley, Paris, 172,000 fr.

(B) Supply of copper electric connections for a year:—

A.E.G., 1·20 fr. each piece of 228 mm. and 1·38 fr. 338 mm. with solid head or 1·31 fr. and 1.496 fr. hollow.
Felten & Guilleaume, Mulheim, 1·21 fr. and 1·39 fr.
Kabelwerk Rheydt, 1·3475 fr. and 1·59 fr.
Compagnie Générale d'Electricité, 1·55 fr. and 1·79 fr.
Treflierie du Havre, 1·55 fr. and 1·85 fr.
Vedovelli & Priestley, 1·62 fr. and 2 fr.
Thomas Bolton & Sons, London, 1·68 fr. and 1·90 fr.

Erith.—The U.D.C. has accepted the tender of Messrs. H. W. Clarke & Co. for 5,500 tons of wharf screenings for the electricity works, at 15s. 11d. per ton.

France.—The French Post and Telegraph authorities in Paris have just given out contracts as follows:—

Geoffroy and Delore, of Clichy.—50 km. single-conductor lead-covered telephone cable, 50 km. double-conductor ditto, and 25 km. seven-pair-conductor ditto, at £4,379.
India-Rubber and Gutta-Percha Co., of Persan-Beaumont (Seine-et-Oise).—100 km. double-conductor lead-covered telephone cable, at £1,592.

G.P.O.—The G.P.O. has again awarded the contract for supplying electric lamps during the current year to the Osram Lamp Works.

Glasgow.—The Arc Lamp Lowering Gear Co., Darlington, has received a further repeat order for 350 sets of complete lowering gear equipment in connection with the improved street lighting in Glasgow referred to in our issue of September 6th.

The T.C.'s Committee on Electricity has accepted the offer of Messrs. Johnson & Phillips for the supply of 400 additional flame lamps. The same Committee, on a report by the engineer, has recommended the Corporation to accept the offer by the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of two additional 500 KW.-rotary converters and switchgear on conditions relative to their running contract.

The T.C.'s Committee on Works and Stores recommends acceptance of the following:—

Fuel for depôts.—John Kennedy & Sons; Wm. Young & Sons; and J. Johnstone & Boath.
D.C.C. copper wire.—British Insulated and Helsby Cables.
Galvanised corrugated sheets.—Smith & M'Lean.

London.—HACKNEY.—The Electricity Committee of the B.C. has accepted the tender of the Strand Building Co., at £18,657, for carrying out extensions to the generating station.

FULHAM.—The B.C. has accepted the tender of Messrs. H. Windsor & Co., at £178, for executing alterations and repairs to the economiser building at the electricity works.

Mersey.—The Mersey Docks and Harbour Board has accepted the tender of Messrs. Higginbottom & Mannock, Ltd., for the supply of an overhead electric travelling crane for the Gladstone Graving Dock engine house.

Newcastle-on-Tyne.—The Tramways Committee has placed an order with Messrs. Parsons & Co., for the erection of a new turbine, at an estimated cost of £7,000.

Southend-on-Sea.—The T.C. has accepted the tender of the Westinghouse Cooper-Hewitt Co., Ltd., for eight mercury vapour lamps for lighting the exterior of the car-shed, at £5 0s. 10d. each; and that of the Municipal Appliances Co., Ltd., of Bamber Bridge, for a sand drier, at £49.

Wallasey.—The tender of Messrs. Sykes & Sugden, Ltd., has been accepted by the Corporation for a supply of boxes, switches, and cut-outs; as has also the tender of Messrs. British Insulated and Helsby Cables, Ltd., for cable, boxes, &c.

West Bromwich.—The T.C. has accepted the tender of the Electrical Engineering and Equipment Co., Ltd., for a supply of cable.

Worksop.—Messrs. E. Bennis & Co. have received a repeat order from the U.D.C. for machine stokers and self-cleaning compressed-air furnaces for its electricity works.

FORTHCOMING EVENTS.

North-Eastern Counties Electrical Exhibition.—Open daily to Saturday, September 28th inclusive. I.E.E. Conference at Exhibition on Monday, 30th inst. At the Exhibition Hall, St. Mary's Place, Newcastle-on-Tyne.

Municipal Tramways Association Conference and Exhibition.—At West Ham Friday, September 27th. Last day of the Conference. For programme see our issue of August 23rd, page 305.

Iron and Steel Institute.—Monday, September 30th, to October 4th. At Leeds. Autumn Meeting.

Society of Engineers.—Monday, October 7th. At 7.30 p.m. At the I.E.E., Victoria Embankment, W.C. Paper on "Town Planning from an Engineering Aspect," by Mr. E. R. Matthews.

International Engineering Exhibition.—October 4th to 26th inclusive. At Olympia.

NOTES.

New Uses for Tungsten.—Tungsten is finding an increasing use in the electrical arts outside its application in incandescent lamp filaments. On account of its high surface tension, the metal is well adapted for sparking or arcing terminals. In some of the newer Crookes or X-ray tubes which are designed to work at enormous intensities, being capable of absorbing 10 KW., and taking "snapshot" skiagraphs of even the thickest parts of the human body, tungsten has been used as the anode target for the cathode rays, the rare metal being backed up with copper to convey away the heat developed. Although rendered molten by even this instantaneous impact of electrons, the great surface tension of the tungsten prevents its loss or change of shape. Tungsten electrodes have also been used for gas-engine spark-gaps and show longer life than those made of other metals of equivalent cost.—*Electrical World.*

Resuscitation after Shock.—At the recent Convention of the Pennsylvania Electric Association, reported in the *Electrical World*, a paper read by Dr. Charles A. Lauffer, of Pittsburg, described the pr me-pr ssure (Schäfer) method of resuscitation as recommended by the National Electric Light Association. The author emphasised the fact that time should not be consumed in removing the body to another place, and that the work of resuscitation must be begun the instant the body is removed from the circuit, even though other places in the neighbourhood may be cleaner. He also stated that in a great majority of cases it was not necessary to know whether the victim's mouth was open, merely that the nose and mouth were free from extraneous obstruction, since the pressure on the floating ribs would force the air out of the nostrils even if the mouth were closed, and breathing could be re-established in this way. Dr. Lauffer stated that the duration of the efforts at artificial respiration should ordinarily exceed an hour, and should be prolonged indefinitely if there were any evidences of returning animation by way of breathing, speaking or movement. Evidences of life were liable to manifest themselves within 25 minutes in patients who would recover from electric shock, and although the chances for recovery of a patient who showed no evidences of life within 25 minutes were rather dubious, the speaker said that where there was doubt the victim should have the benefit of it and no relaxation in the effort at resuscitation should be made so long as the least hope of success remained.

In the discussion which followed, Mr. Liversidge cited a case where victims died from electric shock on 110-volt circuits because they were taken away in an ambulance before any method of resuscitation could be applied. Mr. Conklin asked about the legal responsibility of a company which refused to allow a patient to be taken away by an ambulance surgeon, and Mr. Muller showed the shortcomings of the medical profession in the case of a man who was resuscitated after the physician pronounced him dead.

"Electrolytic Volts."—That electrical engineers have much to learn about electricity, says the *Electrical World*, is indicated in the following account of electrolytic action, which appeared recently in a Montgomery (Ala.) paper: "Harmful as electrolysis may be, it is one of the most interesting freaks that develop in the use of electricity. Electricity is measured by volts and amperes, volts denoting the quantity of the current and amperes its quality, or strength. It is possible for volts to escape from a distributing point, from a trolley car in the rain, and in almost any manner where the wiring may be out of order. They may come down the trolley pole of a street car in rainy weather, be picked up on the damp floor in a woman's silk petticoat, left on the metal plate of a stores door, picked up by the steel tire of a vehicle, but invariably they find their way back to the current-generating dynamo. Left awhile on a piece of metal, the stray volts will feed on it, destroying it, the destruction in such circumstances being known as electrolysis. The 'disease' is something that every institution using metal pipes is constantly on guard against, as far as it can guard, but usually, as in the present instance, the damage is not found out until it is done."

New Westinghouse Club Building.—Building operations have commenced in connection with the erection of a new Westinghouse Club, in Moss Road, Stretford. When completed the club will embrace a miniature rifle range in the basement, a lecture hall, billiard room, two bowling greens and tennis court, and all the means of social and intellectual recreation, the estimated cost being about £3,000. The club will be open to all employés of the British Westinghouse Co.

The Thomas Transmission System.—In our issues of May 5th and June 23rd, 1911, we described at length the above system of electro-mechanical transmission for vehicles, particularly in reference to a Leyland lorry. The firm has, however, extended its activities in directions other than road cars, and, as has been mentioned in this journal, a Leyland rail car, equipped on this system, has been in use on the South African Railways during the year.

This coach has undergone its official trials on the Pretoria-Pienoors route, an 85-mile stretch, with a climb of 1,000 ft. in 42 miles. The results, with 10 stops per double journey, and a gross weight of 23½ tons, show maximum speed on level 50 M.P.H.; average speed, 33 M.P.H.; 9·2 miles per gal. of petrol down hill, and 8·1 miles per gal. up hill, or an average of 8·6 miles per gal. for the double journey. Tests made with the same car hauling a trailer (gross weight 40 tons) on a 90-mile route showed a maximum speed of 45 M.P.H., and an average of 33 M.P.H.; petrol consumption average 5·7 miles per gal.

A letter from Mr. W. W. Hoy, general manager of the South African Railways, states that the acceleration is rapid, a speed of 30 M.P.H. on the level being reached in 48 seconds. Gradients of 1 in 80 can be climbed on the direct drive, and the transmission is such that after starting from rest on a 1 in 80 grade, speed can be increased until the direct drive is attained. Mr. Hoy attributes the good results obtained to the transmission system, and gives the following interesting table showing the ratios in which the power is transmitted mechanically or electrically at the different controller notches. The drive on Nos. 8 and 11 notches is purely mechanical, and no electrical losses are involved: the drive is direct from engine to track wheels without intermediate loss of power.

Notch.	Speed in M.P.H.	Power transmitted Electrically.	Power transmitted Mechanically.
1	8	0·5	0·5
2	12	0·45	0·55
3	16	0·4	0·6
4	19	0·35	0·65
5	22	0·3	0·7
6	24	0·2	0·8
7	27	0·1	0·9
Direct 8	33	0·0	1·0
9	35	0·1	0·9
10	38	0·3	0·7
Direct 11	48	0·0	1·0

Notches Nos. 1 to 4 are purely starting notches, and are never used under running conditions. Under ordinary circumstances, practically the whole of the running would be done on notches 8 or 11, at which points the greatest efficiency is obtained. When the direct drive is in operation at No. 11 notch, the speed can be regulated down to 25 miles per hour by use of the throttle.

The fuel consumption in ton-miles per gallon disclosed by these tests is 228; the best result obtained with a pure petrol-electric vehicle of 42 tons weight, according to German authorities, was 150 ton-miles, while a 30-ton vehicle with mechanical change gear, according to the makers, gives 90 ton-miles.

Mr. Hoy has recommended this type of car and transmission for use on the New Zealand railways.

Glow Lamp Sales in the U.S.A.—According to a report of the Lamp Committee of the National Electric Light Association at its Annual Convention at Seattle, Washington, in June last, carbon lamps show a steady decline, and have been replaced by Gem and tungsten lamps. The sales of tantalum lamps formed only a small proportion of the total, and reached their maximum in 1910, since which year they also show a steady decline. The total sales of domestic lamps of all standard types for the year 1911 were, roughly, 89,000,000 lamps. This is an increase since 1907 of 33½ per cent., the increase being over the year 1909, 20 per cent.; 1910, 12·4 per cent.; and 1911, 8·45 per cent. The percentage of carbon lamps has fallen from 93 per cent. of the total in 1907 to 53 per cent. of the total in 1911. The sales of Gem filament lamps, on the other hand, have increased from 5·88 per cent. in 1907 to 19 per cent. in 1911. The tungsten lamp has increased from an insignificant proportion in 1910 to over 25 per cent. of the total in 1911. The report is also interesting as showing the general adoption of the rating and sizing of lamps in total watts in place of candle-power.

Newcastle Electrical Exhibition Conversazione.—We are asked to draw our readers' attention to a conversazione which has been arranged for the Newcastle Scientific Associations at the Electrical Exhibition, St. Mary's Place, Newcastle-on-Tyne, on Monday next, September 30th, commencing at 6.45 o'clock p.m. This function has been promoted by the Committee of the Newcastle Local Section of the Institution of Electrical Engineers, and members of the kindred scientific associations are invited to attend with their friends. A programme has been arranged for special lectures and demonstrations at definite times on "Wireless Telegraphy," by Prof. Henry Stroud, M.A., D.Sc.; "Electric Cooking," by Messrs. Norman Miller and W. A. Gillot; "Illuminating," by Mr. Haydn Harrison; "Electric Automobiles," by Mr. W. H. Lloyd-Watson; "Electric Signalling," by Mr. James Pigg, electrical engineer for the N.E. Railway. Special arrangements have also been made with the Bros. Dustoffski for their lecture on "Spring Cleaning: Ancient and Modern." An orchestra will give selections during the evening, and light refreshments will be provided. The price of gentlemen's tickets will be 2s. 6d., and ladies' 2s., for which application should be made at once to Mr. H. W. Clothier, Hawthorn Villas, The Green, Wallsend. The President of the Institution of Electrical Engineers, Mr. S. Z. de Ferranti, will receive the guests.

(*Continued on page 505.*)

ELECTRIC WINDING PLANT AT KIPPAX.

As mentioned in the Electrical Review some time ago, the Micklefield Coal Co. are opening new pits at Kippax, some 1½ to 2 miles distant from their existing colliery at Micklefield, Yorks.

Certain stipulations in the lease under which the firm are undertaking this development are of very great interest to electrical engineers, as foreshadowing a policy which may eventually be commonly adopted in the case of new collieries situated in the neighbourhood of large towns, or where it is desired to retain the rural or residential character of the locality.

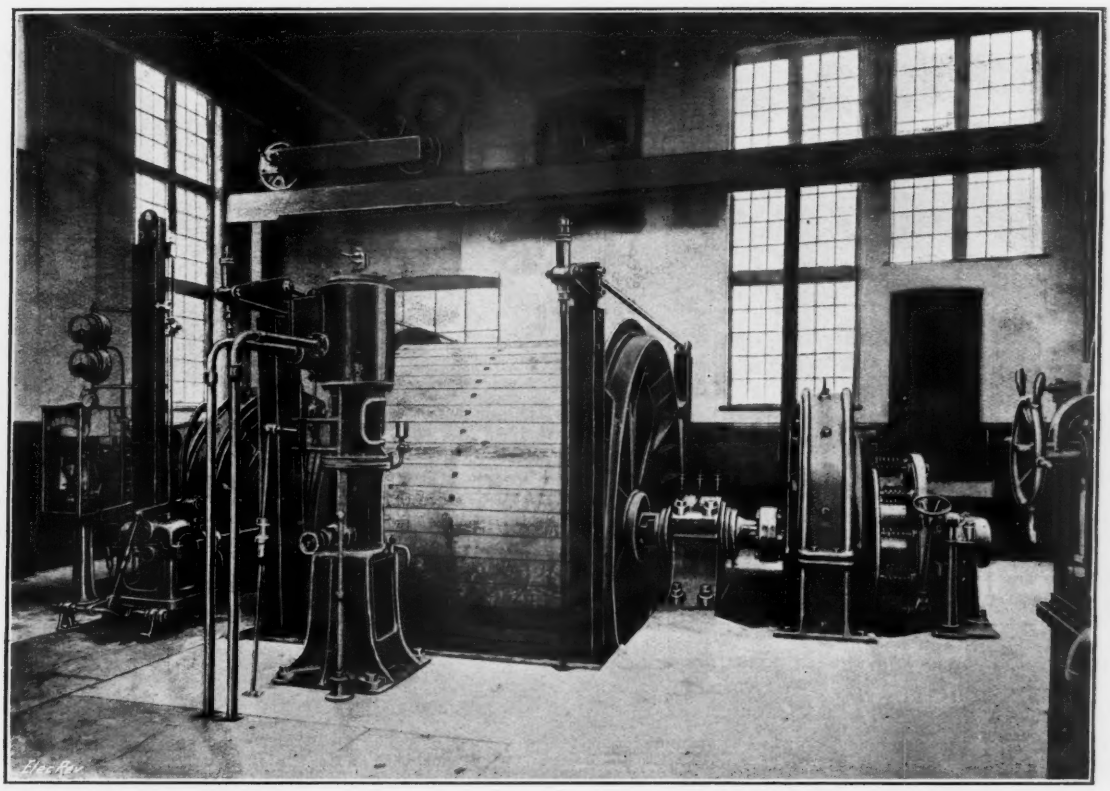
The First Electrical Winding Engine-House and Compressor Building, Kippax.

The conditions in this case provide that no chimney shaft shall be permitted after the sinkings are completed, and also provide for an ornamental winding-engine house and the planting of the dump with trees and shrubs—and obviously point to the adoption of electrical plant, supplied with energy generated in some other locality.

This course has been followed by the Micklefield Co., who have already installed one complete A.E.G.-Lahmeyer winding equipment in a well lighted and somewhat ornamental engine house, shown above, and are preparing to erect a duplicate engine house with a slightly modified and improved equipment almost alongside it, an electrical compressor house coming in between the two. Three-phase 50-cycle current at 10,000 volts is delivered by the Yorkshire Power Co., over duplicate mains, to a sub-station erected in one corner of the existing engine house, and transformed down to 2,000 volts for use on the winding plant.

The erection and setting to work of the first equipment was carried out by the A.E.G., Leeds. The winder was constructed for the following conditions: To deal with 1,500 tons in 10 hours, with net loads of 36 cwt. per lift, and with a winding depth of 300 yards.

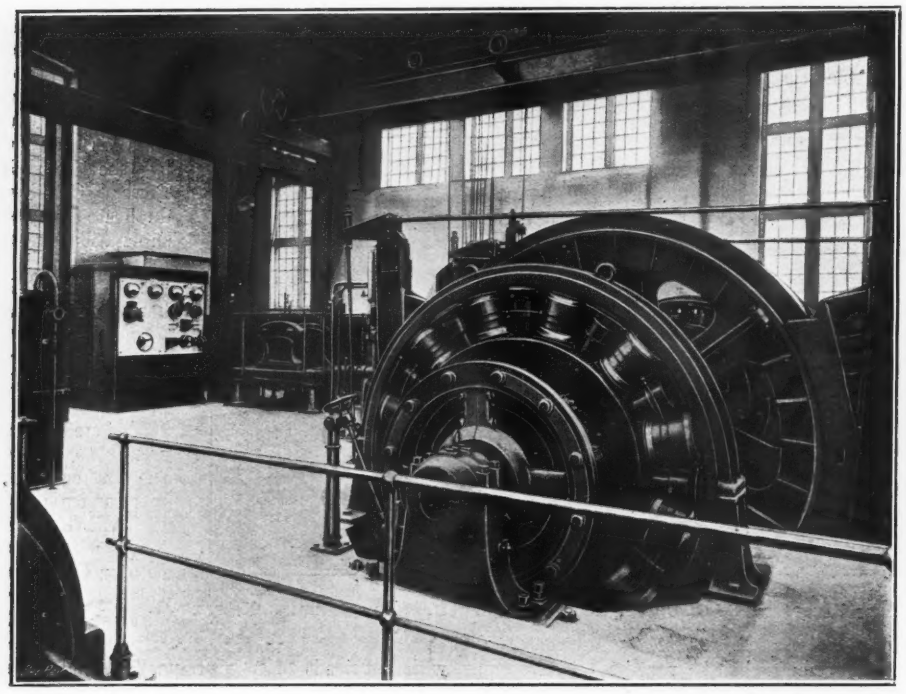
The weight of the cage, &c., is 55 cwt., and of the three trucks (per cage) 5·5 cwt. empty, each truck to carry 12 cwt. of coal; the rope diameter is 1½ in., and a balance rope is used. The number of winds per hour is specified to be 83·5.



General View of Electric Winder.

As regards the arrangement of the plant, which can be seen from our views, the winding engine with a drum 11 ft. in diameter and 6 ft. 8 in. wide, coupled to an interpole winding motor on either side, occupies one corner

of the building, with the fly-wheel converter, and slip regulator on the right hand, the driver's platform, with two levers for the electrical and brake control respectively,



End View of Winder, also Driver's Platform and Winder Switchboard.

and the winder switchboard, being, of course, immediately behind the winder, as shown herewith.

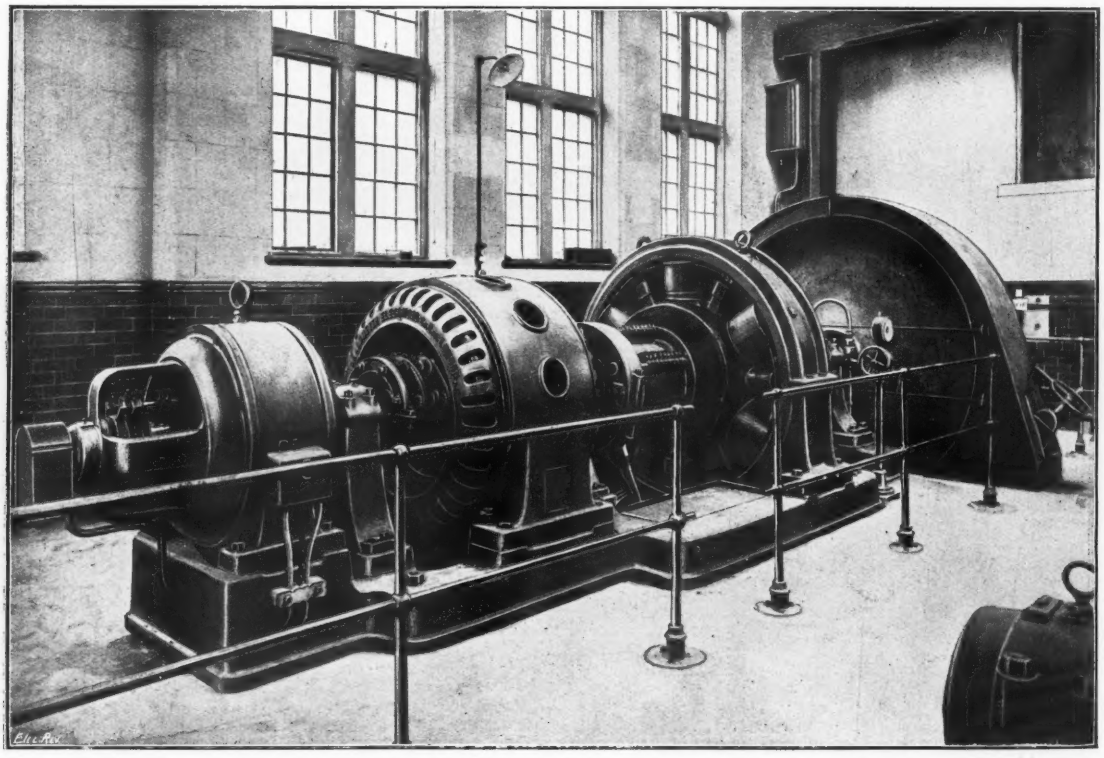
The converter includes a 300-h.p. motor, operating on the 2,000-volt 50-cycle three-phase supply received from the sub-station, within speed limits of 730-640 r.p.m., allowing a slip of 12 per cent.; this machine is coupled on one side to an interpole dynamo, giving a pressure range of 500-0-500 volts, and a 9-ton fly-wheel, and on the other side to a small exciter, the latter being sufficient for the excitation of the dynamo, and of the two winding motors with a drop in speed to 500 r.p.m. With this drop in speed a full wind could be performed even if power were cut off.

The fly-wheel, which is calculated to deliver 5,580 h.p.-seconds with a slip of 12 per cent., has a maximum circumferential speed of 100 metres per second at the synchronous speed of the motor; it revolves in a housing, and is flexibly coupled to the converter shaft, and provided with a band brake, in order to bring it to rest in case of emergency, such as a hot bearing.

Duplicate bearing lubrication systems are provided—ring lubrication, and a gravity circulation system by means of a small rotary pump and elevated tank, so that the ring lubrication is practically an emergency system.

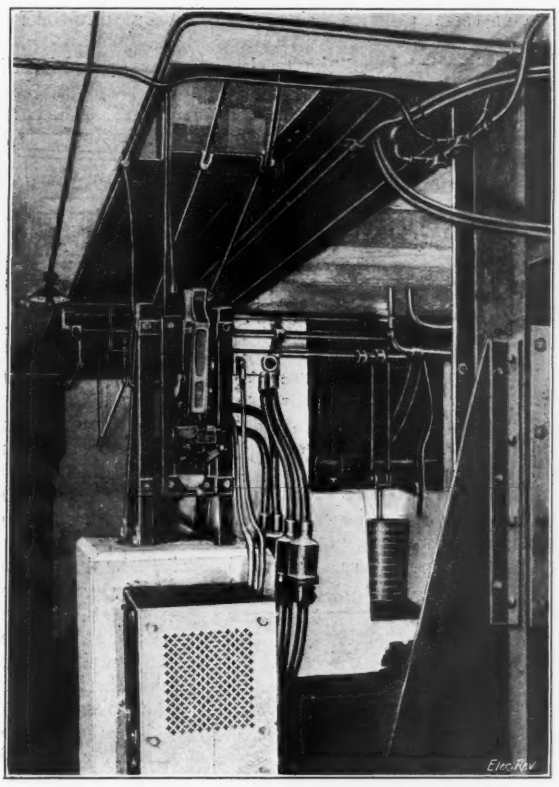
As regards the winding engine, either motor can, in case of emergency, continue winding operations with reduced loads. The normal revolutions are 71 per minute, and the maximum rope speed 12·5 metres per second, the motors being, as previously mentioned, of the interpole type, shunt-wound and arranged for reversing.

The slip regulator, of standard A.E.G. manufacture,



Fly-wheel Converter, Kippax Winder.

which can be seen in some of our views, is of the liquid type, the electrodes in the tank being lifted or lowered according to the load by means of the small series



Control Switch for Fly-wheel Machine (Situated under Driver's Platform.)

induction motor mounted on the top, which is operated from a three-phase current transformer in the main supply circuit to the converter motor.

The transformer has three terminals for each phase, to allow of adjusting the current at which the slip regulator works, and thus regulating the maximum power taken from the mains in conformity with the required output of the winding plant.

The control levers for the engine-man are two in number, one for regulating and reversing the voltage of the converter dynamo by means of a field rheostat under the driver's platform, and the other for operating the manœuvring brake on the winding drum, which is of the post type applied by weights and released by compressed air, the latter being supplied from an automatic electrically-driven compressor in the basement.

The weights also apply the brakes in connection with an emergency braking device operated (*a*) by the driver through a foot pedal; (*b*) from the depth indicator; and (*c*) in case of failure of the excitation voltage.

The switchboard consists of two panels, one containing the instruments and operating switch for the driving motor of the motor-generator, and the other, the instrument and switch for the exciter, two field switches for the winding motors and certain other switches for auxiliary services.

An automatic voltage regulator is provided for the exciter, in which a contact arm is moved to and fro over a series of contacts by means of a screw, motor-driven in either direction by means of open and crossed belts and clutches. The clutches are electromagnetically operated by relays, which, according to the rise and fall of pressure, close one or other of two contacts which close the clutch circuits; the regulation is within 2 or 3 per cent.

It is expected that the winder will operate on 1·64 kw.-hours per ton of coal raised, measured at the incoming meter.

If the winder is not used to its full capacity, it can be worked without the fly-wheel, still avoiding excessive peak loads, due to the method of control, while if running at two-thirds capacity and assuming 15-sec. intervals between successive winds, it is expected that the maximum demand will not exceed some 320 h.p.

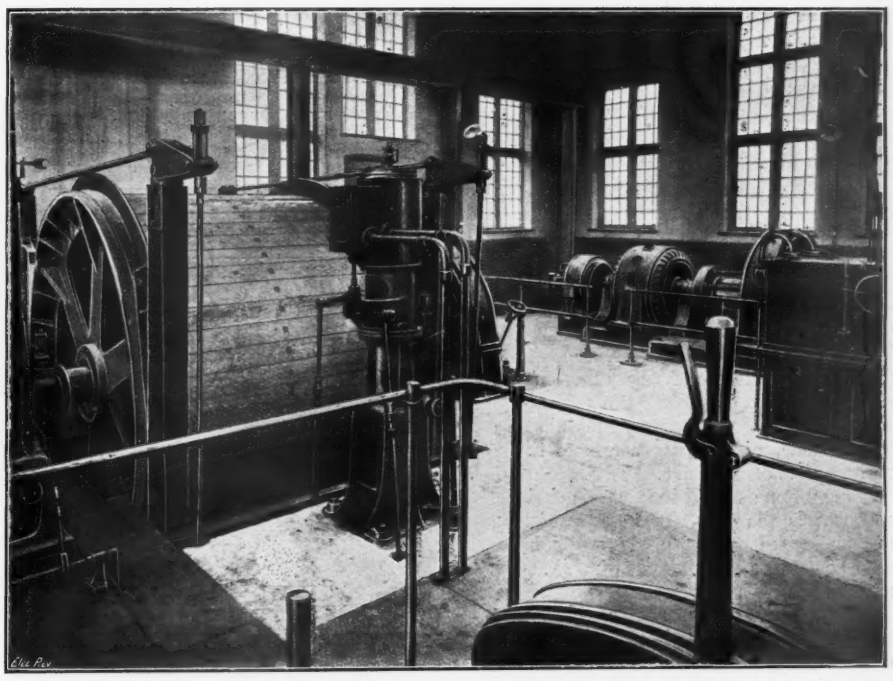
We may add that the second winder, to operate under similar conditions, is being installed by the A.E.G. entirely to their own designs. We are indebted to this company, and particularly to Mr. W. Kobs, of the Leeds branch, for enabling us to prepare this short description of the plant.

COAL-HANDLING PLANT AT THE WIGAN ELECTRICITY WORKS.

Coal is brought to the Corporation electricity works at Wigan in barges, which are unloaded at a point about 80 ft. away from the boiler house.

It became necessary in the interests of economy to provide some effective mechanical means of conveying the coal from the canal to the boiler house. A scheme was, therefore, devised and decided upon, which has recently been put into operation, the results obtained being eminently satisfactory to Mr. J. Slevin, the borough electrical engineer.

The coal is trimmed by hand from the barges into skips,



Engine House from Driver's Platform; Fly-wheel Machine and Slip Regulator on Right.

which are hooked on to a travelling electric transporter running along an overhead track, extending between the boiler house and the canal. The transporter raises the

loaded skips, and carries them along the overhead track, after which they are emptied into a receiving hopper placed above an automatic weighing machine (fig. 4). The weight

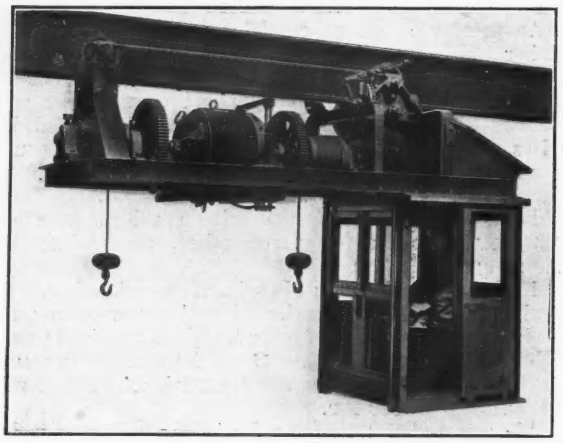


Fig. 1.—Bennis Transporter at Wigan Electricity Works.

of the coal is automatically recorded, and it passes on into a second hopper with two outlets.

The overhead coal bunkers are in two separate sections, in line with each other and about 100 ft. apart; the coal is conveyed to these bunkers by two "Bennis" U-link steel chain conveyors (fig. 2).

These conveyors receive the coal through the two openings in the hopper before mentioned, and are so arranged that both conveyors can run simultaneously or independently of each other, as may be desired.

The conveyors are inclined for the first portion of their length, in order to raise the coal to the level of the top of the bunkers. The remaining portion of the conveyor is horizontal, and passes over the top of the bunkers.

Openings provided with cut-off slides are placed at intervals in the conveyor, through which the coal can be dumped at any desired point.

Each conveyor is driven through suitable reduction gear by a separate motor, independently of the other, and has a capacity of about 20 tons of coal per hour. A gangway runs along at one side, giving easy access to the various parts of the plant.

The "Bennis" U-link steel chain conveyor is shown in fig. 2; it consists of a chain built up of mild steel links, each bent into the form of a "U," and runs in a cast-iron trough.

The electric transporter consists of a travelling hoist, having separate motions for lifting and travelling. Each motion is operated by a separate motor. All the operations of hoisting, travelling and lowering are under the direct control of a single attendant, who travels with the hoist (fig. 1).

The transporter runs on a track which is formed by the base flanges of an "H" section steel joist. The wear is taken by replaceable mild steel flats, which are fastened to the lower flanges of the joist by means of countersunk rivets. The joist is supported on a structure consisting of lattice girders carried on latticed trestle supports, two of these columns being reinforced by ferro-concrete (fig. 3).

The clear height of the track above the ground level is

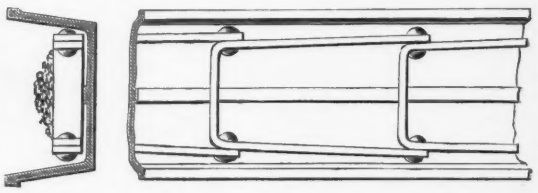


Fig. 2.—Plan and Section of Bennis U-Link Conveyor.

33 ft. 9 in. The structure is built in three spans, the longest of which is about 48 ft.

The bunkers are rectangular in shape, each being 7 ft. 6 in. wide × 7 ft. 9 in. high × 80 ft. long, and are constructed with a framework formed of rolled-steel sections with the intervening spaces filled in with panels of brickwork and concrete, the whole being braced together to form a rigid structure.

Small hoppers are built in the bunker floor, above each chain-grate stoker, and the coal passes by gravity from the bunkers to the stokers through a series of chutes. Each chute is arranged to swing back to admit of access to the boiler tubes. The bunkers are supported on rolled steel joists, built into the boiler-house wall, at one end, and supported on stanchions at the other end.

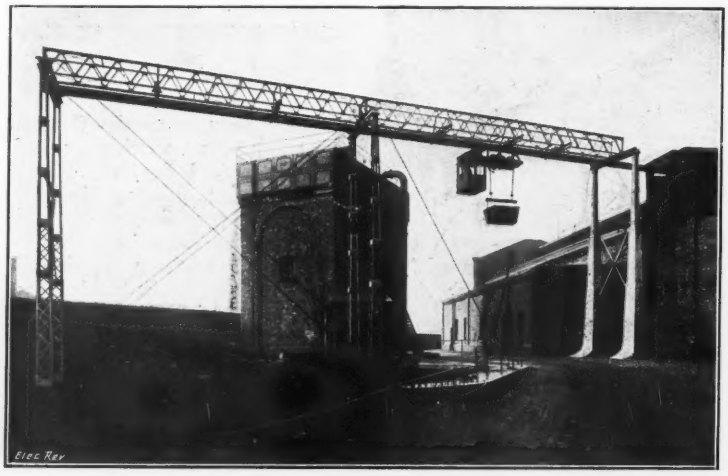


Fig. 3.—Transporter on Overhead Track.

The power required to drive each conveyor at its maximum load is from 3 to 4 B.H.P., and for driving the transporter 5 B.H.P.

The whole of the coal-handling and storage plant, including the transporter, lattice and structural steel work, conveyors, coal bunkers and chutes, was supplied and erected by Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton.

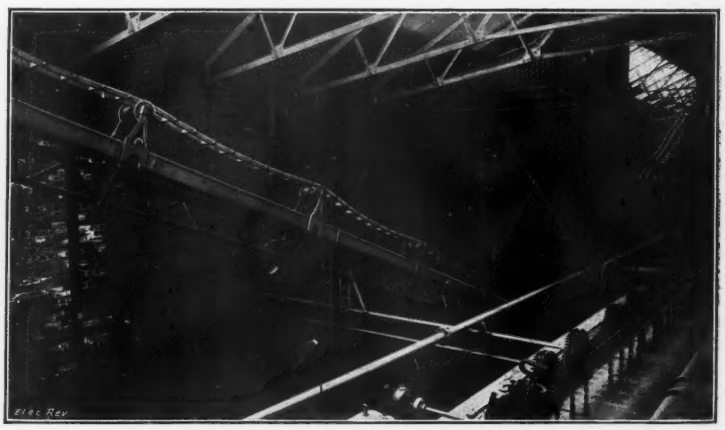


Fig. 4.—Automatic Weighing Machine and Conveyors.

THE MUNICIPAL TRAMWAYS CONFERENCE.

The eleventh annual Conference of the Municipal Tramways Association was opened on Wednesday morning last at the Town Hall, West Ham, where the members were cordially welcomed by the Mayor of that borough, which, as many of our readers are aware, is honoured this year in that the manager of its tramways, Mr. H. E. Blain, occupies the presidential chair.

The Conference extends over three days, the last of which (to-day) contains a larger proportion of pleasure than of business, being principally given up to a motoring excursion to Epping Forest and Rye House.

The Exhibition.

In connection with the Conference a representative exhibition of tramway material was held at the Greengate Street tramway depôt, Plaistow, at which some 60 firms took part, and much that is of interest to tramway people was on view.

There was a well-attended preliminary visit to this exhibition on Tuesday afternoon, and on the two following days set times were arranged in the programme for collective visits by members attending the meetings.

The collection of manufactures on view was considered to be a marked improvement on that at last year's Convention at Glasgow, doubtless due to the matter having been taken in hand at an earlier date, and with a greater zeal, this time. Mr. Blain personally acted as chairman of the Exhibitors' Committee, and the other members were: Messrs. F. Bland (Edgar Allen & Co.), C. Burnet (Tudor Accumulator Co.), A. S. King (United Electric Car Co.), W. L. Lorkin (Equipment and Engineering Co.), E. M. Munro (Brecknell, Munro and Rogers, Ltd.), J. S. Warner (Warner Engineering Co.), with Mr. W. Hopkins as hon. secretary.

An exhibition of this kind undoubtedly forms an added attraction for the tramway official, while it also affords manufacturers an opportunity of showing where they know they will get into close touch with the very men they want to reach. We believe that it will be found that the effort will be more than justified by the results secured by all parties. We can now only indicate broadly the nature of the exhibits in the following :—

A railless electric trolley vehicle (Cedes-Stoll) running from the West Ham tramway conductors outside the depôt, over a ¼-mile section.
A "Tilling-Stevens" petrol-electric 'bus.
A demonstration and exhibit of the Tudor arc welding process for making and repairing rail-joints.
A Thermit rail-welding exhibit and demonstration.
The "P.A.Y.E." tramcar.
Turner's point controller.
The Warner non-parallel axle rolling stock.
Taylor's tubular sanding device.
The Knowles oxy-hydrogen apparatus for rail cutting.
The "Celerity" rail grinder.
Dodwell's point controller.
Brake shoes for railless traction.
"T. and M." single magnet point controller.
Peckham trucks.
The Ackley adjustable brake.
Hadfield's "Hecla" tramway switches.
"United" semi-convertible car.
The Anger brake adjuster.
Barber's radial axle tramcar trucks (working models).
The Peacock wheel and track brake gear.
The "Norwich" portable track grinder.
In addition to these there were a number of exhibits of overhead construction material, electric meters (Chamberlain and Hookham and Ferranti); T.S. gears and pinions, the E.M.B. resistance and Vulcan electric soldering tools (Scholey & Co., Ltd.); Davis's acid fume resisting paint; Major's varnishes and paints; B.I. and Helsby trolley wire, fittings, rail bonds, and "Nephroin" insulation; Edgar Allen's steel points, Lorain "Tadpole" switches, route indicators, "Kyl-Fyre" extinguishers as used in many power stations, Atlas rail joints, Imeson & Finch control fingers, &c., and "Aetna" overhead line material (Watlington & Co., Ltd.). Jenson and Nicholson show their "Robbialac" paint, and "Wattlac" for cables, motors, &c.; the "Wimperis" accelerometer and gradient measurer (Elliott Bros.), P. and B. insulating tape and paints, &c. (Ruberoid Co.). Siemens Bros. "Wotan" lamps for traction service, Brecknell, Munro & Rogers's crossings and other overhead material, section insulators, signalling arrangements, &c.; Birkby's overhead line material (Fleming, Birkby & Goodall, Ltd.), Pinchin, Johnson and Co.'s insulating varnishes, cloths and tapes; an interesting display of aluminium for electrical tramway work by the British Aluminium Co., Ltd.; R. W. Blackwell & Co.'s overhead line insulators and other cognate supplies; carbon brushes (Morgan Crucible Co., Ltd.); weldless steel brake chains; motor spare parts (Dyer & Young); Gabriel lifeguards; insulating varnishes, &c. (Lewis Berger & Sons, Ltd.), also Bambridge flexible shafts, G. W. Green's overhead material, and a number of other general tramway supplies exhibits.

Presidential Address.

To return to the Conference proceedings, there are no aerial flights in Mr. Blain's presidential address, though, as would be expected from such a president, matters are put in a nice way. The address is a brief, businesslike summary of various matters affecting municipal tramway working which the last 12 months have brought into prominence, and some of which will doubtless figure again in subsequent addresses.

The following points may be selected as being of general interest :—

In referring to the interim report of the Corrugation Committee (which came up for discussion later on in the day), Mr. Blain points out the striking difference between the findings of this Committee and the theory which finds favour with many Continental investigators, that corrugation is inherent in the rail. The Committee is of opinion that, whilst a steel for rails can be obtained which is more durable and less liable to the development of corrugation than the ordinary varieties of steel at present mainly used, the chief cause or causes will be found to be external to the rail itself.

Apparently, this investigation has cost more than was expected, and, in view of additional financial assistance being needed, a Presidential suggestion for an increased subscription rate is made, while there also follows a hint that a permanent secretary and office must soon be provided.

The past Parliamentary Session in relation to tramway matters is briefly referred to—the recent trolley 'bus proposals, the L.C.C. fight on the question of trailers, and the future of the Light Railways Bill (1912), being the principal items of interest.

In connection with the Government acquisition of the National Telephone Co.'s business, Mr. Blain mentions that the policy of the company (co-operating with the tramway authorities) in abolishing bare overhead wires, is being reversed by its successors. This has naturally raised a strong protest on the part of the Tramway Executive, and a deputation is to exercise its persuasive powers on the Postmaster-General with view to ending the difficulty.

Mr. Blain touches on the effect of the Insurance Act on tramway undertakings. It has brought onerous financial responsibilities for such undertakings, and he regrets that in the drafting of the Act itself "some more defined and coherent basis covering the trades affected should not have been adopted." The president notes with satisfaction the additional representation of the Association on the Engineering Standards Committee, and the pecuniary benefits following on reduced tramway rating resulting from the Tottenham case.

The most important, and, one might add, the only immediately pressing matter referred to by Mr. Blain, is the question of motor-'bus competition in London. He says :—

"It is difficult for those of us whose work lies within the metropolitan area, where 13½ million pounds have been invested in municipal tramway undertakings, to make any survey of tramway conditions, however limited, without a reference to motor-'bus competition. In the metropolitan area the tramway undertakings are now faced with an exceedingly keen motor-'bus competition, which selects only such routes as are of a distinctly remunerative character, which has no moral responsibility in the direction of providing facilities which are requisite, though not remunerative, which provides no unremunerative travelling facilities for workpeople, which has no legal liabilities in connection with road widenings and maintenance, and is subject to no rates other than those leviable on the buildings and garages it occupies. Whilst recognising to the fullest extent the rights of private enterprise, and the exceedingly valuable traffic facilities which have been furnished by motor-'buses in many areas, it is unreasonable and unfair that when competition of such magnitude exists, there should not be such central authority for the control of traffic as

would be empowered to enact satisfactory street regulations, or the municipally-owned undertakings should not be at the enormous disadvantage (in competition with private enterprise) which is entailed by their road maintenance and rating responsibilities. The difficulty will have to be faced, and faced promptly, and I have never been able to see why, of all the users of the public highway, tramways alone should be called upon to pay so unfair a proportion of road maintenance. If competition is to exist on the public highway for the conveyance of the public, all such means of traction should pay a proportionate cost of road maintenance, should be rated on similar lines, and should be governed in the conduct of traffic by similar public regulations. Special legislation for London is inevitable, but in the interim, the strongest possible influence should be exerted to ensure that the petrol tax at present paid by the London Motor 'Bus Companies (which, to the tune of probably nearly £100,000 a year, is spent by the Road Board in developments in the provinces) should be applied, *pro rata* to the 'bus miles run, in each local authority in the London area over whose roads these companies now operate."

Undoubtedly, Mr. Blain voices the legitimate grievance of the London tramway authorities in this matter, but it seems questionable whether the £100,000 per annum would go very far in any case amongst the numerous authorities, not all blessed with tramways, which could lay claim to a share of it for road maintenance.

In some ways, the plaint of the tramway authorities, who have widened and paved roads, and thus enabled the 'bus to compete efficiently, reminds us of the railway companies' outcry of a few years back, that they were paying rates to provide tramway competition with their own trains. But suburban railway conditions invited competition, which cannot be said in general of present-day tramway facilities. Indeed, were it not for the monopoly of profitable street transit by the 'bus in the heart of the metropolis, the 'bus interests could not have entered into speculative competition with the tramways with any degree of assurance.

Councillor Neumann (Bradford), who followed with a paper on "Tramway Administration by Municipalities, &c.," is evidently one of the advanced school; he discusses both the advantages and disadvantages of municipal control, and quite logically comes to the conclusion that a committee selected for its ability—in fact, something in the nature of the much abused board of directors—is a necessity of the times, even for municipal work.

Both paper and discussion covered a wide field, and the latter in particular revealed a natural interest in the prospects of the motor-'bus, in which connection Mr. Luntley's experience with two or three 'buses, showing costs of 7¼d. per mile, including 25 per cent. depreciation, will not tend to allay misgivings.

At the close of the morning's proceedings, the members and visitors were entertained to luncheon in the Town Hall by the West Ham Corporation, and subsequently the proceedings were resumed at the Plaistow tramway depôt, where the interim report of the Corrugation Committee came up for discussion. The findings of the Committee are of great interest, although, as a speaker pointed out, mainly of a negative character.

Positive evidence has, however, been obtained showing that slip and skid of car wheels take place always (and that a pure rolling motion rarely occurs at all), resulting in attrition and cold flowing of the rail material. We hope to refer to the work of the Committee at a later stage.

At the close of the discussion, many of the visitors adjourned to the Exhibition, and later in the evening a reception was held at the Stratford Town Hall.

(*To be concluded.*)

Apprentices' Strike.—According to the *Times* the engineering trade of the Manchester district has been considerably disorganised by a strike of apprentices On the 20th inst. the strike had extended to 45 firms, and 6,000 youths were idle. "The strikers demand an advance at the rate of 1s. a week, their contention being that, while all other rates of pay have been advanced considerably during the last 20 years, theirs have not Some firms have already granted the demands".

FUEL FOR DIESEL ENGINES.

In a letter to *Engineering* by Mr. J. Lane, the writer is reminiscent of the man in Scripture who, coming to curse, remained to bless, for he certainly succeeds in emphasising a favourable conclusion by the pessimistic tone he adopts in the early part of his letter. Mr. Lane has regarded the Diesel engine from a standpoint somewhat different from that of the engineer who looks on the engine merely as a very successful and efficient heat engine. Accepting the engine on this basis, Mr. Lane inquires rather into the status of the fuel question. Regarding petroleum as a rival of coal in steam raising, and taking the relative heat values of coal and oil as 1 : 1·4, he says that such oil cannot have much cash value. The heat ratio may be freely admitted, but this is not the true ratio, for oil permits of many incidental economies by way of labour in firing, cleaning, and in some cases in carriage.

Even with oil much dearer than the calorific value would indicate, the Diesel engine can produce power so economically, that it becomes a practical commercial motive power at sea. Speaking generally on crude petroleum, the bulk of the crude oils can be split up in the still into several fractions :—(*a*) Those which pass over up to 150° C., known generally as benzene; (*b*) those which pass over from 150° C. to 300° C., classable as lamp oils; (*c*) the solar oils, which are distilled up to 360° C., after which the balance is called residue. There are, of course, higher distillates, and any number of intermediate grades in each class. Of the fractions named, the first class are too costly and too light for use in the Diesel engine. The second, or lamp oil class, are perfectly suitable, but are too readily saleable for the specific purpose which gives them their class name. The solar oils are not produced in great quantity, so that there only remains residue for certain use, though solar oil is really the best technically that could be employed. The world's annual production of oil is about 45 million tons, of which about 29 million tons is residue, and this large figure shows the importance of the capacity of the Diesel to use it. These residues vary greatly in density, viscosity, and constitution, and it is important that every quality should be usable. The marine question is more serious than the problem ashore, for the reason that on land the engine cylinders can be cleaned of the deposits left by unsuitable oils. This cannot be done frequently at sea, and unless the marine engine could be made to secure perfect combustion of all the residual oils, its usefulness would be much cramped. Mr. Lane claims to have made experiments which conclusively prove that the Diesel engine can perfectly consume the heaviest residues, and continue working for a long time without interruption if only the oil contains no extraneous matter, by which is not meant asphalt.

Thus there have been burned the heaviest residue of Roumanian oil, and the liquid pitch from the Trinidad asphalt oil used for road-making, with a specific gravity of 0·98 and hardly fluid at ordinary temperatures. All this has been done without priming, and in an engine of only 100 H.P. with a compression of only 30 to 32 atmospheres, and the weight of fuel used per horse-power hour was practically the same as in the case of solar oil. But we are not told how it was done. It may be assumed that the fuel would be at least well liquefied by heat.

As regards sulphur, this is not regarded as serious if only it is kept dry after burning. But this is an old story. The sulphur in coal only does harm to the economiser where this is cold, and, if the feed water is not below 100° F., appears to be powerless to corrode cast-iron. There was considerable trouble with the early Diesel practice of spraying the oil with the exhaust gases, which were compressed by a small plunger in the engine itself. At least some of the exhaust gases remained in the cylinder, whence the small plunger drew them for its own second stage compression. This small plunger corroded badly, and the system was abandoned and air was compressed pure in the separate double-stage compressors now employed. A French writer in the *Génie Civil* refers to the methods of preparing tar oils for use in Diesel engines. These tar oils, though not possessing even the desirable minimum 10 per cent. of hydrogen, work quite satisfactorily, though only 45 per cent. of the stuff distils

below 300° C., in place of 60 per cent. sometimes asked for. These oils are in regular use, and even crude tar has been experimented with, with considerable success.

There is much to be done before oil can become even seriously competitive with coal, but there are plenty of uses for oil in which it can show to advantage, and there should be a ready market for every ton of oil raised. Why should oil be so dear? Many ask this question. It either comes automatically to the surface, or is mechanically raised by pumps from no very great depths. It can be transported in pipes, pumped into a ship's hold or bunkers, and burned without much labour, yet its price is excessive. It is difficult to find ships to carry it, and difficult to find men who will use it. Yet it is excellent for steam raising and for internal-combustion engines and for metallurgy.

NOTES.

(*Continued from page* 498.)

St. Petersburg Waterworks Contract.—We recently drew attention to the huge undertaking contemplated by the municipality of St. Petersburg, involving the expenditure of no less than 10 million roubles, and including the largest plant for the sterilisation of water with ozone that has yet been projected. Tenders have been submitted for the work by three Continental firms and one English Co. (Ozonair, Ltd.), and from the Russian Press we gather that the former have submitted quotations considerably in excess of the amount voted by the Duma, while the English company has quoted a very much lower price. A St. Petersburg newspaper suggests that the three firms above-mentioned are really in league with one another, and sounds a warning note with regard to the dangers of "syndicates" or rings formed to maintain prices at an unduly inflated volume. The allegation appears to have been the subject of discussion in the city council, and a commission has been appointed to consider the tenders in detail, under the chairmanship of Mr. Barashnikoff, who is referred to as a councillor who has gained the respect and sympathy of the public. Our contemporary urges the commission to clear up the question why the prices of the "syndicate" are so much higher than that of our British *confrères*. The intrusion of the latter, it is suggested, was not contemplated by the "syndicate," which took advantage of its supposed position as holding a monopoly and puffed up the prices.

Ferrantians.—It has been suggested that there should be another foregathering of past and present Ferrantians some time before Christmas. Interested readers should apply to the hon. secretary, Mr. W. E. Warrilow, Mildred Avenue, Watford.

Inquest.—On September 20th an inquest was held at Westminster into the death of Mr. Tinniswood Miller, aged 41, an electrical engineer, of Victoria Street, S.W., who was found shot in his office. The evidence went to show that the deceased's business was not prospering, and that modern taxation had got on his mind. The verdict was one of suicide during temporary insanity.

Fatalities.—On the 19th inst. an inquest was held at Sheffield on Walter Sydney Imisson, aged 18, an apprentice at the works of the Provincial Motor Co., Ltd., Gell Street, Sheffield, who was killed at the works on the previous Tuesday. Dr. P. Edwards, assistant house surgeon at the Royal Hospital, gave evidence that death was due to electric shock.

John Shemeld, a fitter at the works, said that on the morning of the accident he went into some disused closets at the works with another employé named Jepson. Imisson at the time was washing a car at the garage. Witness said that as they came out a gas pipe lay partly across the doorway in such a position as to cause one to step over it. It was leaning up against a wall. He stepped over it, and then went on picking up nuts and bolts. Later he heard a shout, and saw Imisson grasping this bar or pipe with one hand. He immediately put the other hand on, too. At the time witness did not realise what was the matter, but afterwards observing that deceased was getting a shock he ran to the power house and turned off both the main switches, and going back to Imisson expected he would be free. He was, however, lying on the ground in some water. Witness touched his hand to take it off the bar, and he also received a shock. Hammers were obtained, and the wires were broken. Imisson then gave three gasps and died before he was removed to the hospital.

In reply to the Coroner, witness said that until the Tuesday when the accident happened, he did not know that there was anything connected with electricity there. He had not noticed any switch in the place. In answer to further questions, witness said the current of electricity came through the wall from the premises of Messrs. Graves, next door.

Will.—The late Mr. Wm. Yates, mechanical engineer (formerly of Yates & Thom), left £110,925 gross and £94,155 net personalty. Large bequests were made for Blackburn charities and mechanical engineering scholarships.

Ernest Jepson, 128, Heavygate Road, gave similar evidence. In reply to Mr. A. Neal, who appeared for the Provincial Motor Co., he said he remembered, when he first went to work for the company, that the first door leading from the garage to the closets was nailed up, but six months later it was reopened. So far as the management of the garage was concerned, no one ever went into the closets.

There was an adjournment for further evidence, and on Friday the inquest was resumed.

Frederick Bolsover stated that when he worked in premises adjoining those in which the youth was killed he remonstrated with a workman who removed part of the tubing and left the wires loose, with the result that the wires began to fuse in witness's kitchen. At that time, said witness, the pipe that Imisson grasped was fitted to the wall of the lavatory, but afterwards it fell down.

The Deputy Coroner, in summing up, said it would now be almost impossible to find out how the order for the work was given, who did the work, and how he did it. If, as was not at all unlikely, an ordinary workman removed the fittings, he would not have electrical knowledge sufficient to make him responsible for the careless manner in which they were removed, and although it was a careless thing to leave naked wires, it was clear that at the time the cable was left it was not in the highly dangerous position in which it was found on the day of the accident.

The jury returned a verdict that the cause of death was an electric shock due to some person having negligently left an electric cable exposed, but that there was not sufficient evidence to determine who was responsible.

A public inquiry was held in Dingwall on Friday by Sheriff Hay MacWatt into the deaths of a ploughman's daughter, aged 12, and Mrs. Jessie Mackenzie, or Grant, widow, who were killed on August 26th through touching a live wire which conveys electricity to Dingwall. It appeared from the evidence that the wire had come in contact with a branch of a tree and fused, and that the girl, her curiosity aroused, touched the wire and was instantaneously killed. Mrs. Grant and the girl's mother ran to the rescue, when the first-named was killed, while the latter is still suffering from shock. The jury found that had the fuses at the generating station been in proper working order the accident could not have happened; but the accident was unusual, and no man could have foreseen it. They recommended that the whole system be inspected by an expert, to report if the wires are properly protected at all public places.

Educational Notes.—EAST LONDON COLLEGE.—A special course of lectures on "The Management of Public Electric Supply Undertakings" will be delivered by Mr. A. Hugh Seabrook, M.I.E.E., commencing on Monday, October 14th, at 6.30 p.m. The course will cover the relations between the public services and the public, and the objects to be aimed at in the management of public services, as well as the organisation of the staff, the relative importance of management and engineering, the functions of the general manager and engineer, the secretary, and the accountant, the conduct of the generating and distributing plant, the sales department, and tariffs. The lecturer's exceptional experience and well-known uncompromising views are a guarantee that the lectures will be interesting and instructive. Particulars may be obtained from the Principal, Mr. J. L. S. Hatton, at the College, Mile End Road, E.

NORTHAMPTON POLYTECHNIC INSTITUTE.—The new session opened on the 23rd inst. The "announcements" for the session give particulars of the evening classes in electrical engineering, in which department the Institute is exceptionally well equipped with high and low-pressure plant, and in electric wiremen's work. Dr. R. Mullineux Walmsley is the head of the department, and Mr. F. M. Denton, the Associate head. Mr. E. K. Scott delivers a course of lectures on Electrical Engineering Quantities and Estimates. Special evening classes in Telegraphy and Telephony are held by members of the staff of the G.P.O., and Dr. J. Erskine-Murray lectures on Radio-Telegraphy. The day classes commence on Monday next. The degrees of the University of London may be taken through the Institute.

THE POLYTECHNIC, Regent Street, W.—Notice is given in our advertisement pages to-day of the commencement on September 30th of technical classes in telegraphy and telephony.

Newcastle Exhibition.—Correction.—The name of the inventor of the electric water-heater mentioned on p. 516 should be Kratt, not Krabb.

Football.—We have received a card of fixtures of the E.A.C. (Electrical Apparatus Co.) Football Club for the season 1912-13. There are still five open dates, and the secretary, Mr. A. Chittenden, will be pleased to hear from other electrical football clubs in London in respect of these.

Taxes on Electric Motor Vehicles.—Hitherto electric motor vehicles have, for the purposes of the annual taxes imposed on automobiles in this country, been regarded as being of from 12 to 15 H.P., on which scale the annual tax is at present £4 4s. In the report issued last week by the Committee appointed in December last "to consider the Provisional Regulations which have been made under Sec. 86 (2) of the Finance (1909-10) Act for determining the horse-power of motor-cars and to report whether any amendments are desirable with special reference to the equitable treatment of steam cars and electric cars," it is recommended that "any motor-car deriving its power from an electric motor or motors shall be deemed to be of a horse-power exceeding 6½ but not exceeding 12." If the recommendation is adopted, the annual tax on electric vehicles will thus be reduced from £4 4s. to £3 3s.

An International Electro-Culture Congress in France.—An important meeting in connection with the application of motor traction and electricity to agriculture is to be held at Rheims from October 19th to 27th next, the programme comprising an exhibition of motor-propelled agricultural machines of all kinds and a demonstration of the same in practical use. From an electrical point of view, the principal event of the gathering is the International Congress of Electro-Culture and of Applications of Electricity to Agriculture, Viticulture, Horticulture, and to the Agricultural Industries generally. This will be held in Rheims on October 24th, 25th and 26th, and the work of the Congress will be divided into various groups. Section A will be devoted to "Natural Electricities," this including such subjects as atmospheric electricity and its influence on plants, the nitrification of the soil, its action on microbes, &c. Group B will deal with "Electricities Artificially Produced," these embodying current derived from primary and secondary batteries and other means of generation, their effects on plants and the consequent results being considered. Section C will take up the consideration of the influence of continuous and alternating current on plants and the germination of seeds. Another group will devote itself to applications of electricity in pest prevention, and another to the effect of electric light on plants and flowers and in the destruction of insects. Finally, there will be another section, which will treat generally of the uses of electricity in the various branches of agricultural work. As will be seen, the scope of the Congress is exceedingly wide, and it should give an impetus to the application of electricity to agricultural operations. Those interested in the Congress in this country can obtain full particulars from the Secrétariat General, 58, Boulevard Voltaire, Paris.

Institution and Lecture Notes.—The Electrical Association of New South Wales celebrated the attainment of its majority on August 16th at Sydney by a smoking concert. Special invitations had been issued, and according to the *Australian Mining Standard*, there was a brilliant assemblage, representatives being present from the principal kindred organisations in the State, leading electrical firms and Government departments. The concert was voted the most successful yet held.

Institution of Electrical Engineers.—Intending applicants for membership of the Institution, and existing members who are considering transfer from one class to another, are reminded that under the new Articles of Association substantial differences have been established in the matter of entrance fees and annual subscriptions payable by those admitted to the various classes of membership before January 1st, 1913, and those admitted on and after that date. Candidates will find full particulars in the new forms of proposal for election and transfer, which can be obtained on application to the secretary. As a long interval must necessarily elapse between the receipt of a form by the Institution and the date at which the election or transfer, as the case may be, can finally take place, those wishing to avail themselves of the lower rates are advised to send their forms to the secretary at the earliest possible moment, in order to enable the desired election or transfer to be effected before January 1st, 1912.

Two popular lectures will be given by Mr. Frederic H. Taylor at the Willesden Polytechnic, Priory Park Road, Kilburn, N.W., on October 2nd and 4th next, commencing each evening at 8 p.m. Tickets may be obtained on application to the Secretary at the Polytechnic. The titles of the two lectures are:—"The Training of the Engineer with special reference to Electrical Engineering," on the first evening, and "Recent Developments in Electrical Engineering and their Commercial Application," on the second evening.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The recommendation of the Harrogate Lighting Committee that the salary of the borough electrical engineer be increased by £50 a year (mentioned in the Electrical Review last week), has been referred back to the Committee. In February, 1902, the T.C. passed a resolution as to the discontinuance of outside consultation by the electrical engineer, and promised "to further reconsider in a few years the question of compensation to be paid in consequence."

The marriage took place at Salem Church, Hebden Bridge, last week of Mr. Herbert H. Sutcliffe, assistant electrical engineer at Hebden Bridge, and Miss M. Hirst, of Fairfield.

At Barnwell last week, the marriage took place of Mr. J. F. Hall, electrical engineer, of the Burton-on-Trent Corporation electricity staff, and Miss Margaret A. Ogilvie, youngest daughter of the late Mr. R. J. Ogilvie, of Barnwell.

The Tunbridge Wells General Purposes Committee on Saturday last recommended the appointment of Mr. R. N. Torpy as borough electrical engineer. There were 83 applicants. Mr. Torpy has been deputy chief electrical engineer to the Wimbledon Corporation for the last 10 years.

The Bridlington Electricity Committee has appointed Mr. F. French, mains superintendent, as chief assistant engineer at the electricity works, at £130 per annum, rising by £10 a year to £160. The Committee has also appointed Mr. Leslie A. Thain, of Fleetwood, as charge engineer.

Tramway Officials.—The Burnley Corporation tramway staff has presented a Gladstone travelling bag and a silver-mounted umbrella to Inspector Hartley, who is leaving to join the tramway staff at Newport.

General.—The *Glasgow Daily Record* says that Mr. James Simpson, telegraph superintendent, Post Office, Stirling, has retired. "He was one of the few remaining members of the staff taken over when the Government acquired the telegraphs."

At Doncaster Parish Church on September 19th, the marriage took place of Mr. Henry Parry Jones, electrical engineer, of Dolgelly, North Wales, and Miss Mary Jones, second daughter of the late Mr. Robert Jones, also of Dolgelly.

The *Australian Mining Standard* reports that at the annual dinner of the Victorian Institute of Electrical Engineers, on August 9th, the hon. secretary, Mr. E. H. W. Westwood, was presented with a travelling bag. Mr. Westwood was leaving at the end of the same month on a business trip to Europe on behalf of the Union Electric Co., during which he will inspect the leading electrical installations and plants both in Great Britain and on the Continent.

The same Australian contemporary reports that Mr. J. M. Crawford has been appointed assistant electrical engineer on the central staff of the Postmaster-General's Department, his salary being £520 per annum. "Mr. Crawford was not previously in any Australian public service, but was until lately in the British postal department."

Mr. Alan Williams, who is shortly severing his connection with Messrs. Crompton & Co., after 23 years' service, is open to take up another appointment as engineer or manager.

Mr. Leonard F. S. Sington, of the Lord-Howe Electrical Engineering Co., Ltd., Liverpool, was married on September 24th at the Princes Road Synagogue, Liverpool, to Miss Eunice Solomon, eldest daughter of the late Louis Solomon, of Liverpool. The presents, which numbered over 300, included a magnificent rose bowl presented by the staff.

It is reported from Rome that Mr. Marconi has been injured in a motor-car collision while journeying from Spezia to Genoa. His injuries are stated to be slight.

NEW COMPANIES REGISTERED.

Bagdad Tramways and Electric Lighting Syndicate, Ltd. (124,213).—This company was registered on September 12th, with a capital of £3,105 in 3,000 "A" shares of £1 each and 600 "B" and 1,500 ordinary shares of 1s. each, to promote a company or companies for the purpose of constructing, establishing and working in the Ottoman Empire or elsewhere tramways, railways and undertakings for the generation, distribution, supply and employment of electrical energy, and to adopt an agreement with W. B. Cownie. The subscribers (with one "A" share each) are:—W. B. Cownie, 3, Laurence Pountney Hill, E.C., director; T. H. Evans, 4, Broad Street Place, E.C., director. Private company. The number of directors is not to be less than two or more than five; the first are W. Brodie and T. H. Evans; qualification, 50 "A" shares; remuneration, £100 each per annum (chairman £150). Registered office, 3, Laurence Pountney Hill, E.C.

Emanda Engineering Co., Ltd. (124,255).—This company was registered on September 14th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of engines, machines, instruments, tools, appliances and articles used in the electrical, mechanical, automobile engineering and boiler making trades, &c. The subscribers (with one share each) are:—W. E. Upton, 52, Tideswell Road, Eastbourne, engineer; F. Pratt, 13, Musgrove Road, New Cross, engineer's traveller; Mrs. R. Bradford, 13, Musgrove Road, New Cross. Private company. The first directors are W. E. Upon (managing director), F. Pratt, and Mrs. R. Bradford (all permanent); qualification, 25 shares. Registered office, Sumner Avenue, High Street, Peckham, S.E.

Duram, Ltd. (124,295).—This company was registered on September 18th, with a capital of £25,000 in 24,000 ordinary shares of £1 and 20,000 deferred shares of 1s. each, to carry on the business of electricians, mechanical engineers and manufacturers, workers and dealers in electricity and electrical appliances, manufacturing chemists, machinery manufacturers, engineers, founders, smiths and machinists, &c., and to adopt an agreement with C. Gladitz. The subscribers (with one share each) are:—F. W. Warburton, 90, Cannon Street, E.C., merchant; W. A. Pearce, 1, Broad Street Place, E.C., chartered accountant. Private company. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, 100 shares; remuneration as fixed by the company. Registered office, 1¾, Broad Street Place, E.C.

Anglo-Colonial Engineering Co., Ltd. (124,316).—This company was registered on September 19th, with a capital of £1,000 in £1 shares, to carry on the business of mechanical, electrical and general engineers, manufacturers of and dealers in railway coach, tramcar, motor-car and carriage fittings and supplies, &c. The subscribers (with one share each) are:—Col. Vaughan Grimshawe, 16, Coleherne Court, South Kensington, S.W.; H. Brittain, 13, City Road, E.C., engineer; A. J. Smith, 3, Burgoyne Road, Harringay, N., secretary. Private company. The number of directors is not to be less than two or more than five; the first are Col. E. S. Vaughan Grimshawe, H. Brittain and A. J. Smith. Registered office, 13, City Road, E.C.

Williams Electric Co., Ltd. (124,357).—This company was registered on September 20th, with a capital of £20,000 in £1 shares, to carry on the business of a cable, telegraph, telephone and electric light company, and to adopt an agreement with A. Williams. The subscribers (with one share each) are:—F. A. Hole, 2, Draper's Gardens, E.C., stockjobber; A. Williams, Hotel Victoria, S.W., engineer. Private company. The number of directors is not to be less than three or more than seven; the first are A. Williams, J. Abernethy, and two others to be appointed by subscribers; qualification, 100 shares; remuneration (except managing director, if any), £100 per annum, divisible. Registered office, 20, Bucklersbury, E.C.

Sheffield Electric Steel Castings Co., Ltd. (124,289).—This company was registered on September 17th, with a capital of £4,000 in £1 shares, to take over the business of a steel merchant and steel manufacturers' agent, carried on by G. Fischer, as "The Sheffield Electric Steel Castings Co.," at Melbourne Chambers, Cambridge Street, Sheffield. The subscribers (with one share each) are:—G. Fischer, Villa Berg, Schaffhausen, Switzerland, steel manufacturer; P. Altenbach, Hochstrasse, Schaffhausen, Switzerland, manager. Private company. The first directors are G. Fischer and P. Altenbach (both permanent); remuneration, as fixed by the company. Solicitors, Newton & Binns, Melbourne Chambers, Cambridge Street, Sheffield. Registered office, Melbourne Chambers, Cambridge Street, Sheffield.

Universal Radio Syndicate, Ltd. (124,355).—Registered September 20th, by Slaughter & May, 16, Austin Friars, E.C. Capital £100,000 in £1 shares. Objects: To adopt an agreement between Christopher Hago and Dot Kontinentale Syndicat for Poulsen Radio-Telegrafi Aktieselkab, both of Copenhagen, of the one part, and this company of the other part; to apply for purchase or otherwise acquire and hold any patents and concessions relating to the production, treatment, storage, application, distribution and use of electricity; to carry on (subject to the licence of the Postmaster-General or the Board of Trade being obtained in all cases where necessary under any statute of the United Kingdom) the business of a wireless telephone, telegraph and electric light, heat and power supply company; in particular to establish, work, manage, control and regulate, wireless telephone or telegraph stations and works, and to transmit and facilitate the transmission of telephonic and telegraphic communications; also to act as news distributors, press agents and district messengers, &c. The signatories (with one share each) are:—Henry A. Wallon, 55, Chapter Road, Kennington, S.E., clerk; Hugh Pettitt, 18, Austin Friars, E.C., solicitor. Private company. Shares may not be transferred to non-members so long as any member of the company or any nominee of the board is willing to purchase the same at a fair value (to be settled by the auditor in case of disagreement). The first directors (to number not less than three or more than seven) are to be appointed by the subscribers; remuneration as fixed by the company. No notice of registered office filed at time of incorporation.

Oil and Gas Turbine Syndicate, Ltd. (124,303).—Registered September 18th, with capital of £15,000 in 14,750 shares of £1 each and 5,000 founders' shares of 1s. each, to purchase or otherwise acquire any interest in any patents, brevets d'invention, licences, concessions and the like relating to the combustion, treatment, storage, application, distribution and use of fuel, and to carry on the business indicated by the title and that of manufacturers of motors, motor-cars, carriages and vehicles, with either steam, electric, petrol, oil or other power, &c. The subscribers (with one share each) are:—J. McCanna, Broad Street House, E.C., solicitor; R. H. Wheeler, 17, Gracechurch Street, E.C., merchant; D. O. Robertson, 17, Gracechurch Street, E.C., secretary; F. H. Bennett, 17, Gracechurch Street, E.C., clerk; S. E. Glisbey, 7, Narcissus Road, West Hampstead, N.W., clerk; B. Hunter, 4, Granville Road, Stroud Green, N., clerk; W. H. Rose, Broad Street House, New Broad Street, E.C., solicitor. Minimum cash subscription £7. The number of directors is not to be less than two or more than seven; the first are J. McCanna, R. H. Wheeler, D. O. Robertson, F. H. Bennett, S. E. Glisbey, B. Hunter and W. H. Rose (provisional directors). Registered by Rose, McCanna & Co., Broad Street House, E.C.

Liverpool Traction, Light and Power Investment Trust, Ltd. (124,301).—This company has been registered on September 18th, with a capital of £500 in £5 shares, to acquire and hold any stocks, bonds, debentures, shares, scrip or securities of any Government, State, Department, Sovereign or authority, supreme, municipal, local or otherwise, and any bonds, debenture stock, shares, stocks and securities of any company established for the purpose of any railway, tramway, gas, water, dock, electric lighting or power undertaking. The subscribers (with one share each) are:—J. Conybeare, 32a, Quinton Street, Earlsfield, S.W., clerk; A. P. Hollinshead, 29, Forthbridge Road, Clapham, S.W., clerk; H. Hurley, 25, Sidney Road, Stockwell, S.W., clerk; F. W. Davis, 39, Matham Grove, East Dulwich, S.E., clerk; W. J. Simpson, 35, King's Road, Willesden Green, N.W., clerk; G. E. A. Waller, 167, Brondesbury Park, N.W., clerk; F. Hurley, 2, Thornton Street, Brixton, S.W., clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, £5. Registered by Linklater and Co., 2, Bond Court, Walbrook, E.C., solicitors.

Anglo Engineering Co., Ltd. (124,292).—This company was registered on September 18th, with a capital of £3,000 in 1,000 cumulative preference shares of 10s. each and 2,500 ordinary shares of £1 each, to carry on the business of electricians, mechanical and general engineers and manufacturers, workers and dealers in electricity or electrical appliances, motive power and light, &c. The subscribers (with 50 shares each) are:—E. B. Hartel, 183, Lauderdale Mansions, Maida Vale, W., engineer; H. G. Hartel, 32, Adelaide Road, South Hampstead, N.W., engineer. Private company. The number of directors is not to be less than three or more than five; the first are F. P. Wilson (chairman), E. B. Hartel, H. G. Hartel and H. Shakel. Registered office, 33, Kirby Street, Hatton Garden, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Potteries Electric Traction Co., Ltd.—Return dated April 12th (filed July 17th), 1912. Capital, £600,000 in £1 shares (300,000 preference and 300,000 ordinary); 245,000 ordinary and 245,000 preference shares taken up; £423,340 paid on 178,340 ordinary and 245,000 preference; £66,660 considered as paid on 66,660 ordinary. Mortgages and charges: £245,000.

Birmingham and Midland Tramways, Ltd. (19,077).—Return dated June 25th (filed July 8th), 1912. Capital £1,050,000, in 35,000 preference, 35,000 preferred ordinary, and 35,000 deferred shares, all of £10 each. 20,978 preferred, 35,000 preferred ordinary, and 35,000 deferred taken up; £10 per share called up on 20,978 preferred, 27,000 preferred ordinary and 35,000 deferred; £82 1,780 paid; £80,000 considered as paid on 8,000 preferred ordinary. Mortgages and charges: £354,893. (Since the date of the return, a new memorandum of association has been adopted, and the name has been changed to the Birmingham and District Power and Traction Co., Ltd.)

Aron Electricity Meter, Ltd. (58,650).—Return dated July 9th (filed August 25rd), 1912. Capital £350,000 in £1 shares (225,000 ordinary and 125,000 preference). 125,000 ordinary and 124,896 preferred shares taken up; £124,948 10s. paid, including £52 10s. on 104 preferred shares forfeited; £125,000 considered as paid on the ordinary. Mortgages and charges: £100,000.

Corona Lampworks, Ltd.—Issue on August 21st, 1912, of £1,450 debentures, part of a series of which particulars have already been filed.

Wellingborough Electric Supply Co., Ltd. (67,747).—Return dated August 2nd, 1912 (filed August 10th). Capital, £25,000 in £10 shares; all shares taken up and paid for in full. Mortgages and charges: Nil.

Wright Electrical Sales Co., Ltd.—Debenture dated September 4th, 1912, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. W. Newbould, 13, New Station Street, Leeds.

Telephone Co. of Egypt, Ltd.—Act of constitution of mortgage dated May 30th, 1912, created outside the United Kingdom (supplemental to trust deed dated July 27th, 1904, and indentures dated February 21st, 1905, March 4th, 1908, and October 27th, 1909, securing £200,000 debenture stock). The charge secures to the extent of £76,000, the amount owing on the debenture stock. Property charged: Company's immovable property in Egypt. Trustees: G. F. Braithwaite, Kendal, Westmorland, and H. J. Grewing, 26, Queen Anne's Gate, S.W.

Callender's Cable and Construction Co., Ltd. (48,915).—Return dated May 16th, 1912 (filed June 11th). Capital £500,000 in £5 shares (40,000 preferred); 35,000 ordinary and 40,000 preferred shares taken up; £5 per share called up on 15,000 ordinary and 40,000 preferred; £175,000 paid; £100,000 considered as paid on 20,000 shares. Mortgages and charges: £800,000.

British Thomson-Houston Co., Ltd. (47,982).—Return dated May 23rd, 1912 (filed June 12th). Capital £800,000 in £10 shares (40,000 preferred). All shares taken up. £10 per share called up on 32,531 ordinary and 40,000 preferred; £725,310 paid; £74,690 considered as paid on 7,469 ordinary. Mortgages and charges: £249,215.

D. Hulett & Co., Ltd. (29,463).—Return dated July 18th, 1912. Capital, £35,000 in £5 shares; 6,000 shares taken up; £5 per share called up on 1,900; £9,500 paid; £20,500 considered as paid on 4,100. Mortgages and charges: Nil.

Cryselco, Ltd. (58 218).—Return dated July 12th, 1912 (filed August 26th). Capital, £15,000 in £1 shares; all shares taken up; £1 per share called up on 10,007; £10,007 paid; £4,993 considered as paid on 4,993 shares. Mortgages and charges: £9,500.

Indicating Fuse and General Manufacturing Co., Ltd. Debenture dated August 26th, 1912, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. J. Seton, Trunk Cottage, Cove, Farnborough, Hants.

Hellyar & Sons, Ltd.—Mortgage debenture dated August 23rd, 1912, to secure £800, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. L. Hellyar, 8, Meredyth Road, Barnes.

Hydro-Electric Light and Crane Co., Ltd.—Debenture dated September 9th, 1912, to secure £50, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: L. Mallison, The Green, Hampton Court, Surrey.

Bogota Telephone Co., Ltd.—A memorandum of satisfaction in full on July 31st, 1912—(*a*) of trust deed and first mortgage debentures dated May 30th, 1905; and (*b*) of trust deed and second mortgage debentures dated December 12th, 1906, securing £15,000 and £25,000 respectively, has been registered.

Ecuador Telephone Co., Ltd.—Return dated June 26th, 1912 (filed July 3rd). Capital £100,000 in £5 shares; 5,000 shares taken up; £5 per share called up; £25,000 paid. Mortgages and charges: Nil.

Chili Telephone Co., Ltd.—Return dated July 25th, 1912 (filed August 10th). Capital £360,000 in £5 shares; 66,000 shares taken up; £5 per share called up on 44,000; £22,000 paid; £110,000 considered as paid on 22,000 shares. Mortgages and charges: Nil.

Dowsing Radiant Heat Co., Ltd. (59,842).—Charge on 4-5, Dorset Square, Marylebone, dated August 30th, 1912, to secure all moneys due, or to become due, from the company to the London and Provincial Bank, Ltd., 3, Bank Buildings, E.C.

Penarth Electric Lighting Co., Ltd. (52,912).—Return dated June 3rd, 1912 (filed July 30th). Capital £50,000 in £10 shares (2,500 preference); 2,500 ordinary shares taken up; £25,000 paid. Mortgages and charges: £15,937.

Perth Electric Tramways, Ltd. (55,935).—Return dated August 30th, 1912 (filed September 2nd). Capital £200,000 in £1 shares (100,000 preference; all shares taken up and paid for in full. Mortgages and charges: £203,844.

Peterborough Electric Traction Co., Ltd. (74,562).—Return dated May 7th, 1912 (filed July 18th). Capital £60,000 in £5 shares (6,000 preference); 4,400 preference and 4,000 ordinary shares taken up; £5 per share called up on each; £44,000 paid. Mortgages and charges: £21,000.

CITY NOTES.

Buenos Ayres Port and City Tramways, Ltd.

MR. G. KITCHIN, presiding at the meeting of this company held at Salisbury House, London, E.C., on 16th inst., said that for the year ended December, 1911, the total receipts were £69,422, an increase of £15,280, which was mainly attributable to the opening for traffic of the Avellaneda extension. Traffic expenses were £22,115, an increase of £4,450. The charge for electric current was increased in February, 1911, consequent upon the rise of coal, and the amount paid by this company to the German company rose from £7,767 to £11,932. The increased payment for current was quite out of proportion to the increased mileage, and a recent discovery of certain grave faults in the feeder cables probably threw some light on the matter. The net result was a profit balance of £16,256, which was insufficient to meet the interest on the first debenture stock and the extension first mortgage bonds by £8,861. After referring to the company's several concessions at some length, and to the advances made to the Buenos Ayres City and Suburban Tramways, Ltd., which took over some of its concessions for lines to Tigre, the chairman said that the ratio of working expenses had been 76·63, instead of, as they had hoped, about 65 per cent. The year's reduction was only 2·59 per cent., which was totally inadequate for their necessities. The floods—the worst for 20 years—decreased traffic and increased expenses in April and May, 1911. Early this year more capital was required to carry on the financing of the suburban company and for other matters; they therefore placed further extension bonds (£66,900), mainly with old friends of the company, but the proceeds were insufficient to meet the prospective liabilities, and they granted an option on 20,000 preferred unissued ordinary to a firm representing a group that was interested in the company, but the group by further purchases in the market and elsewhere, obtained a sufficient number of ordinary and preferred ordinary shares to give them the control of the voting power of the company. The group acted for Messrs. Lacroze, of London and Buenos Ayres, and alterations in the composition of the board followed. The new members of the board had only been in office a fortnight, so it was not possible to lay before them any statement of the course of action to be adopted with the advent of the new *régime*.

The report was adopted.

Eastern Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 3½ per cent. per annum on the preference stock for the quarter to September 30th, and the second quarterly interim dividend of 1½ per cent. on the ordinary stock.

Underground Electric Railways Co. of London, Ltd.

The Right Hon. Sir Edgar Speyer, Bart. (chairman), presided on Thursday, September 19th, at the Westminster Palace Hotel, S.W., over the half-yearly meeting of the above company.

The Chairman, in moving the adoption of the report (see Elec. Rev., August 16th), congratulated the shareholders on the substantial progress made during the period under review, which, he said, he thought would remain one of the most important periods in the company's history. He referred to the acquisition of the London General Omnibus Co. by the company, the consequences of which would only be fully felt as time went on. Progress, however, had not been confined to this fusion and the advantages that flowed from it. Both the London Electric and the District Railways had made good records—records all the more creditable considering the period of strikes that they had to face and having regard to the fact that their earnings had to compare with the abnormally large Coronation traffic of the corresponding period of 1911. As shareholders in these companies they would benefit in the near future from the expenditure that was being made in connection with the Charing Cross and Paddington extensions. These extensions should be ready within 12 months, and would afford excellent means of interchange between these railways at Charing Cross—viz., District, Bakerloo and Hampstead—and would also afford a splendid service of trains direct to the Paddington Station of the Great Western Railway. These improvements, if past experience was any criterion, would be taken advantage of by the public, and should prove a source of profit to the company. Further, the extension of the Bakerloo Railway from Paddington to a physical connection with the electrified suburban lines of the London and North-Western Railway at Queen's Park Station, and a through service of trains to Watford, would provide the Paddington and Kilburn districts with a much-needed service of trains, and also the increasing suburban population of Watford, Pinner, Harrow, Sudbury, Willesden, &c., with direct communication with the West-End and the entire underground system of London. The District Railway, too, would gradually reap advantages from the widened lines between Ravenscourt Park and Turnham Green, which permits of a greatly improved service to Ealing and the western lines. The development of its western territory generally was encouraging. As pointed out by Lord George Hamilton, the chairman of the District Railway, in spite of an increase of 640,000 miles in car-milage, the earnings per car-mile were 9·59d, an increase of ·19d. compared with the corresponding period of 1911. Lastly, they had to bear in mind that the advantages of the co-operation of the London General Omnibus Co. with these railways would only be gradually but increasingly felt. Services would be more and more co-ordinated, and 'buses used very largely to feed the railways, and traffic on the railways would be stimulated thereby, for traffic facilities begot traffic. These were all favourable factors which made for increased earnings on both the District and London Electric Railways. As regarded the latter, it should not be long before the 4 per cent. dividend on the preference stock was earned more than twice over. This was very nearly the case now, and under the circumstances this stock had now become an investment of a high order, which fact was a true measure of the London Electric Railways' advancing and enhanced credit, reached within a comparatively short space of time. As regarded the accounts, the revenue account showed total receipts of £215,714, an increase of £57,178, or about 36 per cent., on the first half of 1911, and the net revenue before allowing for income bond interest was £132,446, a gain of £92,950. The income derived from investments was £207,851, which was £101,876 more than in the corresponding half of the previous year. The income from investments included £113,590 income from their holding of ordinary stock in the London General Omnibus Co. This income was, of course, reduced by the interest on the income debenture stock and on income bonds issued by the company in exchange for the London General Omnibus stock. The rents of properties, less expenses in connection with same, rose from £1,798 to £2,407. These various increases in revenue enabled the company to pay interest on the income bonds at the rate of 4 per cent. per annum, and to carry forward a balance of £2,676, as compared with interest at the rate of 1½ per cent. and an amount of £246 carried to reserve in the corresponding period of 1911. The half-year under review had been charged with £2,110 for expenses in connection with the redemption of a portion of the 4½ per cent. bonds, as compared with an amount of £1,565 so charged in the last half-year in connection with the redemption of prior lien bonds. With regard to the balance-sheet, the credit side had been considerably simplified in consequence of the sale of the power house undertaking. The items referring to the power house and the various power house funds had, of course, disappeared, and the profit over the book value of the power house had enabled the directors to write off the item of preliminary and other expenses and the cumulative revenue deficiencies, besides enabling them to write down the item of commission and discount from about £818,000 to £474,000. On the debit side of the balance-sheet the unpaid calls were reduced by £104,000. It was expected that the interest, amounting to approximately £35 000 in respect of these calls, would be received very shortly. This amount, when received, with the exception of £13,000 for which credit had been taken in former half years, would be available for the revenue account of the company. Further, the £1,000,000 first power house debentures which had been paid off out of the proceeds of the sale of the power house, and also various suspense items, had disappeared. On the other hand, the liabilities had been increased by the income debenture stock and income bonds issued in exchange for the London General Omnibus ordinary stock acquired. With regard to the appeal in the Westinghouse case, the House of Lords had decided that the award was to be remitted to the arbitrator, and as the matter was therefore *sub judice*, they must await the arbitrator's further decision. The House of Lords had held that the question of the superiority of the Parsons turbines which they brought in mitigation of the damages caused by the Westinghouse turbines not being up to contract, was a relevant matter for the arbitrator's consideration. The London United Tramways did not really come under review at this time as their financial year did not end until December 31st. Through careful and painstaking management, the company was holding its own pretty well considering adverse circumstances, but that was all that could be said. Since the chairman of the London United Tramways addressed his shareholders on January 30th, the award regarding that company's lines in Hammersmith had been given by Mr. Elliott Cooper, the arbitrator appointed by the Board of Trade, but inasmuch as the London Council had given notice of an appeal it was not possible for him to make any definite statement at this time. They would be interested to know that the combined system of trams, railways and 'buses carried now about 700,000,000 passengers annually, and that the system's passenger earnings amount to over £4,000,000. They furnished this service more cheaply and more expeditiously, and, he thought they might claim, with greater comparative comfort, than any other city in the world. The public showed its appreciation of their performance by more frequent travel, as evidenced by the striking increase of journeys per head of population. It might not be amiss for him to say a word about the accident which occurred on the Piccadilly Railway on the 4th inst. While they deplored the accident, which fortunately did not result in any loss of life, but only very slight injuries to several of the passengers and staff, they could point with pride to the magnificent record made by these London railways, not only as regarded immunity from accidents to passengers and staff, but also in regard to the speed, regularity and closeness of service, which, in the opinion of those best qualified to judge, was not excelled, if it was equalled, by any other railway in the world. As they were no doubt aware, steel cars were exclusively used on the tubes, and it was satisfactory to state that the wisdom of the management in having adopted this material had been amply vindicated. As the cars withstood the shock remarkably well, and as they were immune from fire, they had proved a great element of safety. Since the opening of the London Electric and the electrification of the District Railways, 929,315,363 passengers had been carried, 41,109,664 train-miles had been run, and in the movement of the trains the signals had been operated over 2,400,000,000 times—all of which had been accomplished without a single fatality due to a failure either in the rolling stock or signal system. This was a splendid record, and should fully satisfy everyone as to the safety of these railways. The accident to which he had just referred was now the subject of an inquiry by the Board of Trade, and it was, therefore, unnecessary and out of place for him to say more at this time except that the public might be assured that everything that human ingenuity could contrive to make the railways absolutely safe would be adopted. The chairman proceeded to refer to the statement appearing in the Press that morning to the effect that the Associated Omnibus Co. had entered into an arrangement with the London General Omnibus Co. for the purchase of 55 motor-'buses which had been paid for by the issue of second debentures. The 'buses would be run by the General Omnibus Co., and a proportion of the earnings would be paid to the Associated Co. He thought the arrangement would prove satisfactory to both parties. Having commented on the acceptance of a seat on the board by Sir Herbert Jekyll and the fact that this would be the last half-yearly meeting the company would probably hold, the chairman said that when addressing them in February he ventured to express the opinion that the year 1912 would be a very prosperous one for London and the country generally, and that this prosperity would also favourably affect their companies. In spite of the various strikes his predictions had been realised, and it looked as if 1913 would equal, if indeed it did not surpass, its predecessor, and if they did not deceive them, these good times, bringing enhanced profits and greater living margins, would be reflected in more frequent travelling of the population of London, and consequently increased earnings to the system. They were justified therefore in looking forward to further progress and larger distributions in the not too distant future.

Lord George Hamilton seconded the motion, and the report was adopted without discussion.

On the motion of Mr. J. Culham Pound a vote of thanks was accorded the board.

United Electric Car Co., Ltd.

The annual meeting was held at Preston on September 18th. Mr. Geo. Richardson presided, and said that the net profit for the year was £15,267, which was the best since 1907, although they had been considerably handicapped by railway and coal strikes, both in the difficulty of obtaining supplies and in high cost of materials. There was an available balance of £14,749, and the directors recommended that this be disposed of as follows: Preference dividend for the half-year to June 30th, £3,000; 5 per cent. on the ordinary shares, £7,500; carrying forward to next year, £4,249. There was a reduction in rent, rates and taxes of about £1,000, due to the disposal of the Trafford Park works. The debtors showed an increase of over £40,000, due to the increased volume of business transacted. Sundry creditors showed a decrease of about £13,000. With regard to the future, their order book was not very full. They could not rely on the home trade to keep them going, although the time must be approaching when corporations who has been running cars for 10 or 12 years would have to face the gradual purchase of new rolling stock to replace

some of the earlier cars. They already saw signs that they were beginning to realise this fact. Moreover, the large English corporations who had erected works for the construction of new cars and repairs to old ones, had realised that it would pay them better to buy their cars and confine their works to the repair and upkeep of rolling stock. The chairman added that the Insurance Act would cost the company about £750 to £1,200 a year, according to the output. This would be a further handicap when competing with Belgian and German builders.

MR. MYLCHREEST was informed that £25,000 of the debenture shares were to be redeemed.

The report was adopted. Messrs. Richardson and Boddington were re-elected directors, and the re-election of Mr. Kerr as a director was unanimously approved.

The CHAIRMAN said he was now 76. After that meeting he was going to resign the position of chairman. The knowledge of his retirement was lightened when he informed them that Mr. Barningham would succeed him.

German Electrical Companies.

THE *Elektrizitäts Gesellschaft vorm. H. Poege, of Chemnitz*, after placing £15,000 to depreciation in 1911-12, as against £7,700 in the previous year, proposes to pay a dividend of 7½ per cent. on capital of £175,000, thus comparing with the same rate on £125,000 in 1910-11.

The *Bergmann Elektrizitäts Unternehmungen*, which incurred a loss of £15,000 in the first financial year, are stated by the parent undertaking (Bergmann Electricity Works Co.) to have increased the loss in 1911-12. It has now been arranged that the latter shall take over the former's department which has hitherto been engaged in the execution of contracts, installations, &c., for other parties, and the subsidiary company will, in future, be substantially devoted to the development of its three overhead central stations, and one electric railway.

The *Brandenburg Carbid und Elektrizitätswerke, of Berlin*, report that the results in 1911-12 from the production of carbide and the sale of electricity were more favourable than in the preceding year, although the exceptionally dry summer in 1911 exercised a disadvantageous influence. The reduction in the output of carbide caused by the dry weather was counteracted by the acquisition of a large quantity of carbide from another producer, and the company was therefore able to deliver its full allotment in the carbide syndicate. As the contracts entered into before the formation of the syndicate had been completed, it was possible to obtain higher average prices. After placing the sum of £6,100 to depreciation the accounts show net profits of £7,900 for 1911-12, as compared with £5,700 in the previous year, and it is proposed to pay a dividend of 4 per cent., being the same rate as in 1910-11.

The directors of the *Moore Licht A.G., of Berlin*, state that the sales organisation in 1911-12 necessitated a further financial sacrifice, and the profits on the increased turnover did not suffice to meet the working expenses. A fresh loss was also incurred on the French business, which had been transferred to the Société d'Eclairage par Tubes Luminescents Système Moore, whilst the Spanish patents had also been disposed of at an acceptable price. The Russian licence had been withdrawn, and the company intended to develop that market. The accounts indicate a loss of £13,000, as contrasted with a loss of £17,000 in 1910-11, which was extinguished by the calling up of shares and by additional payments being made on other shares, leaving £9,800 to be transferred to the reserve fund. This fund has been absorbed by the further loss in 1911-12, and has left a debit balance to be carried forward.

Yorkshire Electric Power Co., Ltd.

MR. A. G. LUPTON presided on 17th inst. at the half-yearly meeting of this company held at Leeds. In moving the adoption of the report (see ELEC. REV., September 13th), he said that despite the coal strike their customers were kept fully supplied with current. The revenue for the period had slightly increased, principally owing to a steady growth in the H.P. of motors in works of customers already connected to the mains. They had a further 1,000 H.P. of motors for new customers waiting and pressing to be taken on, from which they would get a further increase of revenue in the last quarter of this year. It had been a difficult year, and had checked their growth, but the company were making real progress, and they were convinced that success was coming. In spite of the extra costs entailed, he thought that they would earn their full preference interest for this half-year, but in any case it was cumulative, and next year would show a great increase of revenue. Eighteen months ago the steady growth of net receipts seemed to be bringing the ordinary shares within measurable distance of a dividend. This, however, had been delayed by breakdowns of plant and by the coal strike, but with the extra plant now installed, and with the turbines fully at work again, before the end of the year the revenue for 1913 would show a very considerable increase, and the costs per unit would be proportionately decreased. The chairman, referring to the proposed new issue of £50,000 6 per cent. preference capital, said that it was proposed to erect a waste heat station for the generation of electricity from coke oven gas at Barugh, near Barnsley. This would be done by a separate company, the shares to be held by the power company. A prospectus would be issued shortly. During the past year there had been a 20 per cent. increase in the amount of electricity sold from the power station, and the new waste heat station was, therefore, imperative. It would give an independent supply, relieving the mains by feeding into them at their southern point, whilst the supply would be obtained at a lower cost of production, and would not be affected by the fluctuating price of coal. The provision of this station would absorb £25,000 of the £50,000 extra preference capital now proposed to be raised. The gross profit for the past six months was, he added, £800 less than in 1911, but £850 more than that in 1910 for the corresponding period.

MR. T. O. CALLENDER seconded the adoption of the report, and said he had the fullest confidence in the undertaking; he said that as representing the largest shareholders.

After questions the report was adopted.

An extraordinary general meeting which followed decided to issue a further 10,000 preference shares of £5 each, which existing shareholders and customers would have the privilege of applying for first.

Cleveland and Durham Electric Power Co., Ltd.

—The report states (says the *Financier*) that during March, April and May last a direct loss of about £8,000 was incurred in consequence of the national coal strike. The gross profits for the year to June 30th amounted to £25,784, as against £20,973 for the previous year. The capital expenditure on works was £10,333. After providing for debenture and other interest, there remains a net profit of £6,720, which with £8,343 brought forward, gives a balance of £15,063 to be distributed as follows:—Dividend at 2 per cent. on the preference shares £6,674; in writing off discount on second debentures, £2,800; in transferring to depreciation and renewals account, £2,000; carrying forward £3,589. During the 12 months the company started to work additional waste-heat generating stations at the Lackenby ironworks of the Tees Furnace Co., the Horden and Shotton Collieries of the Horden Collieries, Ltd., and the Port Clarence ironworks of Messrs. Bell Bros., Ltd., Middlesbrough.

We have received a lengthy circular from Mr. A. Gemmell, a shareholder, and formerly secretary of certain associated companies, criticising the balance-sheet and setting out a number of points for "searching examination."

STOCKS AND SHARES.

Tuesday Evening.

THE fine weather seems to have lured people and business away from the Stock Exchange. Markets have fallen into quietude, and although there is a fair amount of investment, speculators are not what may be called enterprising just now. In regard to the Electrical sections, business continues active enough in two or three of the Underground Railways stocks; but in the Supply market there is little going on, and the gamble in Marconi's has dwindled away to a shadow of what it was.

English Electricity Supply shares hold all the strength to which attention has been called lately, and there are further rises in City Preference and London Electric Ordinary this week. Paragraphs continue to appear in newspapers fanning the suggestion of linking-up the Metropolitan undertakings, and those of the borough councils, but there seems to be good ground for supposing that negotiations are no further advanced in this direction than they were some time ago, except, of course, that a lot of very useful spade work has been done in bringing ideas into harmony and establishing at least a knowledge of what is required by the various interests concerned.

It will be noticed that to our price lists over-leaf we have added a column giving the dividends for 1912. The records are necessarily imperfect until the autumn of any year, and, even so, a fair number of blank spaces remain to be filled in. Most of the announcements so far have been those of interim dividends, and we have endeavoured to show where this is the case. Time and care have been expended over the preparation of the table, and, in a silence as profound as profane, the widely differing periods during which companies make up their accounts have been diligently studied. As, however, it is very difficult to ensure absolute accuracy in this respect, we shall be grateful for corrections of whatever mistakes have eluded our vigilance and crept into the fair record.

The Home Railway market has been more absorbed in the gyrations of Metropolitans than in anything else. Each day has brought a crop of rumours and denials, upon the strength of which the price has bobbed up and down like an animated tennis ball. On balance the change is comparatively trifling, and up to Tuesday evening, when we write, no official announcement had been made with reference to the stock being taken over by one of the company's bigger brethren on the basis of a guaranteed dividend. Districts went back a little towards the end of the settlement, and Underground Electric Railways shares are easier in both classes. In some quarters the view is held that the Underground Railways Company is approaching its full capacity; and while it may be correct so far as the purely London lines are concerned, manifestly much scope remains in the direction of the suburbs. The penetration of the motor-'bus into such outlying districts as Burnham Beeches, St. Albans, Warlingham, and similar places, shows what an energetic management can do; and therefore it may be that the final circumference of the Underground Companies' activities is by no means attained even yet. Sir Edgar Speyer spoke with cheerful optimism at the company's meeting last week, and his speech had the effect of bringing in buyers for the income bonds, which are again a point to the good.

London United Tramways had a mysterious dip to 3¾, but rallied again to 4⅛, thus being ⅛ down on balance. City and South London stock lost ⅛ on its last week's rise, and then regained it,

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Further, the extension of the Bakerloo Railway from Paddington to a physical connection with the electrified suburban lines of the London and North-Western Railway at Queen's Park Station, and a through service of trains to Watford, would provide the Paddington and Kilburn districts with a much-needed service of trains, and also the increasing suburban population of Watford, Pinner, Harrow, Sudbury, Willesden, &c., with direct communication with the West-End and the entire underground system of London. The District Railway, too, would gradually reap advantages from the widened lines between Ravenscourt Park and Turnham Green, which permits of a greatly improved service to Ealing and the western lines. The development of its western territory generally was encouraging. 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The items referring to the power house and the various power house funds had, of course, disappeared, and the profit over the book value of the power house had enabled the directors to write off the item of preliminary and other expenses and the cumulative revenue deficiencies, besides enabling them to write down the item of commission and discount from about £818,000 to £474,000. On the debit side of the balance-sheet the unpaid calls were reduced by £104,000. It was expected that the interest, amounting to approximately £35 000 in respect of these calls, would be received very shortly. This amount, when received, with the exception of £13,000 for which credit had been taken in former half years, would be available for the revenue account of the company. Further, the £1,000,000 first power house debentures which had been paid off out of the proceeds of the sale of the power house, and also various suspense items, had disappeared. 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In spite of the various strikes his predictions had been realised, and it looked as if 1913 would equal, if indeed it did not surpass, its predecessor, and if they did not deceive them, these good times, bringing enhanced profits and greater living margins, would be reflected in more frequent travelling of the population of London, and consequently increased earnings to the system. They were justified therefore in looking forward to further progress and larger distributions in the not too distant future.

Lord George Hamilton seconded the motion, and the report was adopted without discussion.

On the motion of Mr. J. Culham Pound a vote of thanks was accorded the board.

United Electric Car Co., Ltd.

The annual meeting was held at Preston on September 18th. Mr. Geo. Richardson presided, and said that the net profit for the year was £15,267, which was the best since 1907, although they had been considerably handicapped by railway and coal strikes, both in the difficulty of obtaining supplies and in high cost of materials. There was an available balance of £14,749, and the directors recommended that this be disposed of as follows: Preference dividend for the half-year to June 30th, £3,000; 5 per cent. on the ordinary shares, £7,500; carrying forward to next year, £4,249. There was a reduction in rent, rates and taxes of about £1,000, due to the disposal of the Trafford Park works. The debtors showed an increase of over £40,000, due to the increased volume of business transacted. Sundry creditors showed a decrease of about £13,000. With regard to the future, their order book was not very full. They could not rely on the home trade to keep them going, although the time must be approaching when corporations who has been running cars for 10 or 12 years would have to face the gradual purchase of new rolling stock to replace

some of the earlier cars. They already saw signs that they were beginning to realise this fact. Moreover, the large English corporations who had erected works for the construction of new cars and repairs to old ones, had realised that it would pay them better to buy their cars and confine their works to the repair and upkeep of rolling stock. The chairman added that the Insurance Act would cost the company about £750 to £1,200 a year, according to the output. This would be a further handicap when competing with Belgian and German builders.

MR. MYLCHREEST was informed that £25,000 of the debenture shares were to be redeemed.

The report was adopted. Messrs. Richardson and Boddington were re-elected directors, and the re-election of Mr. Kerr as a director was unanimously approved.

The CHAIRMAN said he was now 76. After that meeting he was going to resign the position of chairman. The knowledge of his retirement was lightened when he informed them that Mr. Barningham would succeed him.

German Electrical Companies.

THE *Elektrizitäts Gesellschaft vorm. H. Poege, of Chemnitz*, after placing £15,000 to depreciation in 1911-12, as against £7,700 in the previous year, proposes to pay a dividend of 7½ per cent. on capital of £175,000, thus comparing with the same rate on £125,000 in 1910-11.

The *Bergmann Elektrizitäts Unternehmungen*, which incurred a loss of £15,000 in the first financial year, are stated by the parent undertaking (Bergmann Electricity Works Co.) to have increased the loss in 1911-12. It has now been arranged that the latter shall take over the former's department which has hitherto been engaged in the execution of contracts, installations, &c., for other parties, and the subsidiary company will, in future, be substantially devoted to the development of its three overhead central stations, and one electric railway.

The *Brandenburg Carbid und Elektrizitätswerke, of Berlin*, report that the results in 1911-12 from the production of carbide and the sale of electricity were more favourable than in the preceding year, although the exceptionally dry summer in 1911 exercised a disadvantageous influence. The reduction in the output of carbide caused by the dry weather was counteracted by the acquisition of a large quantity of carbide from another producer, and the company was therefore able to deliver its full allotment in the carbide syndicate. As the contracts entered into before the formation of the syndicate had been completed, it was possible to obtain higher average prices. After placing the sum of £6,100 to depreciation the accounts show net profits of £7,900 for 1911-12, as compared with £5,700 in the previous year, and it is proposed to pay a dividend of 4 per cent., being the same rate as in 1910-11.

The directors of the *Moore Licht A.G., of Berlin*, state that the sales organisation in 1911-12 necessitated a further financial sacrifice, and the profits on the increased turnover did not suffice to meet the working expenses. A fresh loss was also incurred on the French business, which had been transferred to the Société d'Eclairage par Tubes Luminescents Système Moore, whilst the Spanish patents had also been disposed of at an acceptable price. The Russian licence had been withdrawn, and the company intended to develop that market. The accounts indicate a loss of £13,000, as contrasted with a loss of £17,000 in 1910-11, which was extinguished by the calling up of shares and by additional payments being made on other shares, leaving £9,800 to be transferred to the reserve fund. This fund has been absorbed by the further loss in 1911-12, and has left a debit balance to be carried forward.

Yorkshire Electric Power Co., Ltd.

MR. A. G. LUPTON presided on 17th inst. at the half-yearly meeting of this company held at Leeds. In moving the adoption of the report (see ELEC. REV., September 13th), he said that despite the coal strike their customers were kept fully supplied with current. The revenue for the period had slightly increased, principally owing to a steady growth in the H.P. of motors in works of customers already connected to the mains. They had a further 1,000 H.P. of motors for new customers waiting and pressing to be taken on, from which they would get a further increase of revenue in the last quarter of this year. It had been a difficult year, and had checked their growth, but the company were making real progress, and they were convinced that success was coming. In spite of the extra costs entailed, he thought that they would earn their full preference interest for this half-year, but in any case it was cumulative, and next year would show a great increase of revenue. Eighteen months ago the steady growth of net receipts seemed to be bringing the ordinary shares within measurable distance of a dividend. This, however, had been delayed by breakdowns of plant and by the coal strike, but with the extra plant now installed, and with the turbines fully at work again, before the end of the year the revenue for 1913 would show a very considerable increase, and the costs per unit would be proportionately decreased. The chairman, referring to the proposed new issue of £50,000 6 per cent. preference capital, said that it was proposed to erect a waste heat station for the generation of electricity from coke oven gas at Barugh, near Barnsley. This would be done by a separate company, the shares to be held by the power company. A prospectus would be issued shortly. During the past year there had been a 20 per cent. increase in the amount of electricity sold from the power station, and the new waste heat station was, therefore, imperative. It would give an independent supply, relieving the mains by feeding into them at their southern point, whilst the supply would be obtained at a lower cost of production, and would not be affected by the fluctuating price of coal. The provision of this station would absorb £25,000 of the £50,000 extra preference capital now proposed to be raised. The gross profit for the past six months was, he added, £800 less than in 1911, but £850 more than that in 1910 for the corresponding period.

MR. T. O. CALLENDER seconded the adoption of the report, and said he had the fullest confidence in the undertaking; he said that as representing the largest shareholders.

After questions the report was adopted.

An extraordinary general meeting which followed decided to issue a further 10,000 preference shares of £5 each, which existing shareholders and customers would have the privilege of applying for first.

Cleveland and Durham Electric Power Co., Ltd.

—The report states (says the *Financier*) that during March, April and May last a direct loss of about £8,000 was incurred in consequence of the national coal strike. The gross profits for the year to June 30th amounted to £25,784, as against £20,973 for the previous year. The capital expenditure on works was £10,333. After providing for debenture and other interest, there remains a net profit of £6,720, which with £8,343 brought forward, gives a balance of £15,063 to be distributed as follows:—Dividend at 2 per cent. on the preference shares £6,674; in writing off discount on second debentures, £2,800; in transferring to depreciation and renewals account, £2,000; carrying forward £3,589. During the 12 months the company started to work additional waste-heat generating stations at the Lackenby ironworks of the Tees Furnace Co., the Horden and Shotton Collieries of the Horden Collieries, Ltd., and the Port Clarence ironworks of Messrs. Bell Bros., Ltd., Middlesbrough.

We have received a lengthy circular from Mr. A. Gemmell, a shareholder, and formerly secretary of certain associated companies, criticising the balance-sheet and setting out a number of points for "searching examination."

STOCKS AND SHARES.

Tuesday Evening.

THE fine weather seems to have lured people and business away from the Stock Exchange. Markets have fallen into quietude, and although there is a fair amount of investment, speculators are not what may be called enterprising just now. In regard to the Electrical sections, business continues active enough in two or three of the Underground Railways stocks; but in the Supply market there is little going on, and the gamble in Marconi's has dwindled away to a shadow of what it was.

English Electricity Supply shares hold all the strength to which attention has been called lately, and there are further rises in City Preference and London Electric Ordinary this week. Paragraphs continue to appear in newspapers fanning the suggestion of linking-up the Metropolitan undertakings, and those of the borough councils, but there seems to be good ground for supposing that negotiations are no further advanced in this direction than they were some time ago, except, of course, that a lot of very useful spade work has been done in bringing ideas into harmony and establishing at least a knowledge of what is required by the various interests concerned.

It will be noticed that to our price lists over-leaf we have added a column giving the dividends for 1912. The records are necessarily imperfect until the autumn of any year, and, even so, a fair number of blank spaces remain to be filled in. Most of the announcements so far have been those of interim dividends, and we have endeavoured to show where this is the case. Time and care have been expended over the preparation of the table, and, in a silence as profound as profane, the widely differing periods during which companies make up their accounts have been diligently studied. As, however, it is very difficult to ensure absolute accuracy in this respect, we shall be grateful for corrections of whatever mistakes have eluded our vigilance and crept into the fair record.

The Home Railway market has been more absorbed in the gyrations of Metropolitans than in anything else. Each day has brought a crop of rumours and denials, upon the strength of which the price has bobbed up and down like an animated tennis ball. On balance the change is comparatively trifling, and up to Tuesday evening, when we write, no official announcement had been made with reference to the stock being taken over by one of the company's bigger brethren on the basis of a guaranteed dividend. Districts went back a little towards the end of the settlement, and Underground Electric Railways shares are easier in both classes. In some quarters the view is held that the Underground Railways Company is approaching its full capacity; and while it may be correct so far as the purely London lines are concerned, manifestly much scope remains in the direction of the suburbs. The penetration of the motor-'bus into such outlying districts as Burnham Beeches, St. Albans, Warlingham, and similar places, shows what an energetic management can do; and therefore it may be that the final circumference of the Underground Companies' activities is by no means attained even yet. Sir Edgar Speyer spoke with cheerful optimism at the company's meeting last week, and his speech had the effect of bringing in buyers for the income bonds, which are again a point to the good.

London United Tramways had a mysterious dip to 3¾, but rallied again to 4⅛, thus being ¼ down on balance. City and South London stock lost ¼ on its last week's rise, and then regained it,

Central Londons retained their advances. East London Ordinary, after being 10½, reacted to 9¾—and the East London Railway, it may be mentioned in passing, is one of those said to be concerned in the working agreement proposals which are to embrace the Metropolitan. Great Northern and City Preferred fell back ⅛. Business has been marked at 40s. Dublin Tramways Preference were put up 30s. on a small inquiry from Dublin, this rectifying the quotation which for some time past has been left incorrect in the London list in consequence of the absence of dealing.

Foreign Electrical issues are steady to good. Important rises have taken place in Rio Trams, Sao Paulo Trams, Montreal Light, Heat and Power, and British Columbia Deferred. Any stock that comes to market is readily taken, and there is no difficulty in disposing of substantial amounts. Mexico Trams picked up the point which they lost last week, and Mexican Electric Light 5 per cent. bonds have started to recover part of their smart fall of a week ago. On the other hand, Mexican Light and Power Common is weak. Shawinigan Water Capital stock put on 2; the price will be marked *ex* rights at the end of the week. Monterey Debenture yielded a little, and two or three of the other bond issues are slightly lower, but Vera Cruz at 95½ shows an improvement. Anglo-Argentine Tramways Second Preference are somewhat pressed for sale, and have receded a further ⅛. Columbia Gas and Electric shares, the new introduction to the market last week, rose to 19, reacted to 17¾, and at the time of writing are 18¾. Two or three new issues are spoken of as likely to be made in this department before long. Victoria Falls Preference attracted a little buying in consequence of the opening of the company's first station at Vereeniging, and it is expected that the remaining three will be working shortly. The shares carry about a year's arrears of dividend still, and this the company should have no difficulty in paying off, possibly at the end of the year. The 5½ per cent. Debenture scrip is quoted about 96; there is a coupon of £2 9s. 5d. due in December, after which the full amount becomes due half-yearly.

In the telegraph market the feature is the strength of Anglo-American stock. Anglo "A" again shows a rise, and the Ordinary stock has moved up to 69. Apart from sentimental considerations, the relative quotations for the three stocks—Ordinary, Preferred and Deferred—ought to stand on much the same line; and it will be noticed from the catalogue of yields that this level is being gradually attained. Submarine Cables Trust certificates are 1 higher. West Indian and Panama Debentures rose ½, and Amazon Debenture at 97 is a similar amount better. The only move in the Eastern group is ½ rise in Eastern and South African (Mauritius) Debenture. West India and Panama shares remain dullish, there being no life in the market for the moment.

National Telephone Deferred stock is unchanged, but the Marconi market is depressed. At one time, shares in the parent company were offered at 5⅛, though a subsequent recovery replaced part of the loss, and on the week the fall amounts to ¼ in both Ordinary and Preference.

Castner-Kellners at 3⅛ show a further improvement, on the anticipation of a good dividend, and Telegraph Construction Debenture has moved up to par as its top figure. Henleys and India Rubbers retained their rises, but British Insulated shares weakened a little, and British Aluminium Ordinary fell back 1/16 to 12s. 6d. middle. The Rubber Share market has relapsed into depression due to the dwindling of the price of the raw material. The auction sales this week produced heavy shipments, and Mincing Lane has not got used to the marketing of rubber up to 800 tons per fortnight. It is stated in some quarters that the present quotation for rubber is more or less artificial, and that the big buyers are of set purpose holding back from appearing as purchasers; but as to this it is hard for the layman to form any real judgment, seeing that the big buyers are widely scattered and their operations are hidden, except to the imagination. In the metal markets the strength of zinc, spelter and the like is causing a boomlet in the shares of the mining companies dealing with these materials, and the Stock Exchange views with complacency the prospect for further improvement. But then it must be remembered that the Stock Exchange very rarely sees—or admits that it sees—the chance of anything falling, so long as the market in that particular thing is exuberantly on the rise.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Bolton (Thomas) & Sons, Ltd.—£800,000 5 per cent. first mortgage debentures of £100 each (registered).

And to allow the following to be quoted in the Official List:—

Bombay Electric Supply and Tramways Co., Ltd.—60,000 ordinary shares of £10 each fully paid.

Georgia Light, Power and Railways.—$679,000 additional first lien 5 per cent. 30-year gold bonds of $1,000 each, Nos. 2,281 to 2,909.

The Committee has ordered the undermentioned to be quoted in the Official List:—

Oxford Electric Co., Ltd.—10,000 5 per cent. cumulative preference shares of £5 each fully paid, Nos. 1 to 10,000.

Puebla Tramway, Light and Power Co.—$3,000,000 prior lien 5 per cent. 50-year gold bonds, Nos. A1 to A1,000 of $100, B1 to B4,800 of $500, and C1 to C500 of $1,000 each, in lieu of the scrip.

Continental.—Russia.—The capital of the Société de la Fabrique Russe d'Accumulateurs Tudor, of St. Petersburg, is being increased from 1,200,000 to 2,400,000 roubles.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, September 25th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£26 10	£1 15 inc.
a Lead, Nitrate	,,	£26 10	..
a ,, White Sugar	,,	£35 10	..
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3¾d.	..
a ,, Crystals	per ton	£8 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£82	£2 inc.
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	..
c ,, Tube (brazed)	,,	11⅞d.	..
c ,, ,, (solid drawn)	,,	1/-d.	..
c ,, Wire, basis	,,	9¼d.	..
c Copper Tubes (brazed)	,,	1/0¾d.	..
c ,, ,, (solid drawn)	,,	11⅝d.	..
g ,, Bars (best selected)	per ton	£95	..
g ,, Sheet	,,	£95	..
g ,, Rod	,,	£95	..
d ,, (Electrolytic) Bars	,,	£82 10s.	..
d ,, ,, Sheets	,,	£100 10s.	..
d ,, ,, Rods	,,	£89	..
d ,, ,, H.C. Wire	per lb.	10½d.	..
f Ebonite Rod	,,	5/3	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/7	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	4/7½	2¾d. dec.
l Iron Pig (Cleveland warrants)	per ton	66/10½	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£22 10 to £23	£1 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5	..
e Mica (in original cases) small	per lb.	6d. to 8s.	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 11/-	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£230 to £230 10	£5 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/7	1d. inc.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£31 2 6	10s. inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Folkestone Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share), less income-tax, on the ordinary shares for the half-year ended June 30th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors announce an interim dividend for the quarter ended June 30th last of 2s. 6d. per share.

American Telephone and Telegraph Co.—The directors have declared the usual quarterly dividend of $2 per share.

Anglo-Portuguese Telephone Co., Ltd.—The directors have declared an interim dividend at the rate of 3 per cent., free of income-tax.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 24th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9⅜ — 10⅜	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅜	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅛ — 10⅜	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord.	5	10	9†	8⅜ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	7¾ — 8⅛	..	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8⅜ — 4½	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	17½ — 19	..	4 4 3
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	+ ½	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 3
County of London, Ord.	10	6	4†	11½ — 12 xd	..	5 0 0
Do. 6 % Pref.	10	6	6	11⅜ — 12½ xd	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6†	4⅝ — 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	..	7⅛ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½	..	1⅝ — 2⅛	+ ⅛	3 10 8
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅝ — 4½	..	4 14 2
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	5⅝ — 6⅛ xd	..	5 16 0
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9½	..	5 5 3
Do. 7 % Pref.	5	7	7	6½ — 7½	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord.	5	2	..	1⅜ — 1⅞	..	..
South London, Ord.	4	5	..	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅜	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	£3	Nil	..	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	5	2	..	2⅛ — 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80½ — 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8⅝ — 9⅛	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛	..	4 8 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8½	..	7⅛ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	95 — 97	— ½	5 3 1
Canadian Gen. El. Com.	$100	7	7	114 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	3	..	⅞ — 1	..	3 4 0
Do. 5 % Deb.	100	..	..	16 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95⅛ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	15/16 — 1	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87 — 89	+ ½	5 12 4
Mexican Lt. & Power, Common	$100	4	4†	93 — 97	—2	4 2 6
Do. 7 % Cum. Pref.	$100	7	7	109 —112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	—1½	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	86½ — 88½	— ½	5 13 0
Montreal, Lt., H. and Power	$100	8	9†	240 —250	+10½	3 4 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5†	39 — 42	..	..
River Plate, Ord.	Stock	10	..	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 —104	+1	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	5	5	154 —159	+2	3 2 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	94 — 97	+1½	5 3 1
Victoria Falls Power, Pref.	1	11¾d.	17⅜d.	5/16 — 1/3	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7½ — 7⅞	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	+ ½	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	149 —151	+2	5 6 0
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph	Stock	3	3	68 — 70	+ ½	5 7 2
Do. 6 % Pref.	Do.	6	6	113½ —114½	..	5 4 10
Do. Def.	Do.	30/-	..	26⅝ — 26⅞	+ ⅛	5 11 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅜ — 7⅞	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83½ — 85½	..	4 13 7
Cuba Telegraph	10	6	..	9⅜ — 10⅛	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ — 17⅝	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	..	3⅛ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅜ — 7⅛	..	6 17 11
Direct United States Cable	10	5	4	7⅛ — 8	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130 —133	..	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	7⅜ — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½ —101½	..	3 18 10
Eastern Extension	10	7	7†	18⅛ — 18⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	98½ —100½	..	3 19 7
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	+ ½	3 19 8
Globe Telegraph and Trust	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12⅜ — 13⅛	..	4 10 7
Great Northern Telegraph	10	18	18	28⅛ — 29¼	..	6 1 0
Indo-European Telegraph	25	13	..	57 — 59	..	5 3 5
Mackay Companies Common	$100	5	5†	87 — 91 xd	..	5 9 11
Do. 4 % Cum. Pref.	$100	4	4	68 — 71 xd	..	5 12 3
Marconi's Wireless Telegraph	1	20	..	5⅜ — 5⅝	— ⅛	3 15 6
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅜ — 4½	— ⅛	3 11 9
Monte Video Telephone, Ord.	1	6	..	1⅝ — 1 5/8	..	5 6 3
Do. 5 % Pref.	1	5	5	1 5/16 — 1 7/16	..	5 6 3
National Telephone Def.	Stock	6	..	155 —157	..	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100⅜ —101⅜	+ ⅛	4 8 5
Oriental Telep. and Elec.	1	8	..	1½ — 1⅝	..	4 8 2
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1 7/16	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18
Reuter's	10	10	..	10½ — 10⅝	..	3 14 5
Submarine Cables Trust	Cert.	6	6	128 —131	+1	4 11 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ —101½	..	4 8 8
United River Plate Telephone	5	8	..	7⅜ — 7⅝	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1½ — 1⅝	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3½ — 3⅝	..	..
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10⅛	..	5 17 0
Do. 5 % Debs.	100	5	5	101 —103	+ ½	4 17 1
Western Telegraph, Ltd.	10	7	7†	13½ — 13⅝	..	5 1 10
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Paid in deferred interest warrants. ‡ 9s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 24th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	—	..	Nil
Do. 5 % Pref.	1	5	5	—	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	..	..
Do. 5 % Perp. Deb.	100	5	5	98 —101	..	4 19 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	8	8†	77 — 79	..	3 15 11
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	77 — 79	..	2 10 8
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1⅝	1½†	39½— 40½	..	3 7 11
Do. 5 % Pref., 1891	100	5	5	106 —108	..	4 12 7
Do. Do. 1896	100	5	5	104 —106	+1	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	+1½	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅞ — 2⅛	— ⅛	Nil
Hastings Trams, 6 % Pref.	1	6	..	—	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2⅜ — 2⅝	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	4⅛ — 5	— ¼	..
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 24th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1½	1½†	63 — 63½	+ ½	2 11 2
Do. Surplus Lands	..	2½	2½†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	41⅞— 42½	— ⅜	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	..	1 — 1	..	5 1 2
Do. Def.	1	Nil	..	—	..	Nil
Do. 5 % Pref.	1	5	5	—	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	+1	4 10 0
Do. 5 % Deb.	100	5	5	100 —103	..	4 17 1
Potteries, Ord.	1	3½	..	—	..	..
Do. 5 % Pref.	1	5	5	—	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	1 —	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4⅜ — 4⅝	— ⅛	Nil
Do. "A"	1/-	..	..	—	—	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	91 — 93	+ 1	..
Yorkshire (West Riding), Ord.	5	Nil	..	—	..	Nil
Do. 6 % Pref.	5	3	..	2⅞ — 3⅛	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	5⅛ — 5⅜	..	5 2 4
Do. 2nd Pref.	5	5½	5½	4 1/16 — 5 1/16	— 1/16	5 3 6
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	103½ —105½	+ ½	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	..	7⅛ — 7⅜	..	5 4 11
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def.	100	8	..	145 —150	+2	5 6 8
Do. Pref. Ord.	100	6	6	120 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	+ ½	4 7 0
Calcutta Trams, Ord.	5	7	..	6⅜ — 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	—	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅝ — 5⅞	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	—	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	—	..	..
Do. Pref.	1	6	..	—	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	..	1 1/16 — 1 1/8	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	91 — 94	+1	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	127 —130	+1	5 7 8
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	— ½	5 0 10
Do. 6 % Bonds	100	6	6	102⅜—104½	..	5 14 10
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7⅜ — 7⅝	..	6 7 0
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½—102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord.	1	5	5†	1⅜ — 1⅝	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 1/16 — 5⅜	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	156 —158	+4	3 3 3
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	— ¼	4 16 2
Do. 5 % Mort. Bonds	100	5	5	101½—102½	+ ⅛	4 17 7
Sao Paulo Tram, Lt. and P.	$100	10	10†	266 —270	+4½	3 14 1
Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 14 0
Singapore Trams, 5 % Deb.	100	5	5	84 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	4⅝ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101½—103½ xd	..	4 7 0

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	—	..	8 0 0
Do. 6 % Pref.	1	6	6	1 1/16 — 1 1/8	..	7 7 8
Babcock & Wilcox	1	28	..	3⅜ — 3½	..	4 2 10
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	3 16 10
British Aluminium, Ord.	1	Nil	..	—	— 1/16	..
Do. 6 % Cum. Pref.	1	Nil	..	—	..	..
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 88	..	5 13 8
B.I. & Helsby Cables	5	10	..	7⅝ — 8⅛	— ⅛	6 3 1
Do. Pref.	5	6	6	5⅝ — 6⅞	..	4 11 1
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref.	3	Nil	Nil	—	..	Nil
Do. Deb.	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 —	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8
Do. 4½ % Second Deb.	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10⅛ — 11	..	6 16 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	99⅛—101⅛	..	4 8 8
Castner-Kellner	1	20	15†	31⅛ — 31⅝	+ 1/16	5 1 7
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
Crompton & Co.	8	Nil	..	—	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	..	—	..	5 14 3
Do. Pref.	1	5	..	—	..	5 6 8
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £8 paid	5	Nil	..	—	..	Nil
Do. fully paid	5	Nil	..	—	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb.	100	5	5	74 — 77	..	6 9 10
Electric Construction	2	2½	3⅛	—	..	7 10 0
Do. Pref.	2	7	7	—	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅜ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb.	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	17	5†	12⅛ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4⅞ — 5	..	4 10 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	11⅛ — 12½	..	..
Do. Pref.	10	5	5	9⅛ — 10⅛	..	4 17 7
Telegraph Construction	12	17½	5†	34 — 36	..	6 13 4
Do. Deb.	100	4	4	98 —100	+1	4 0 0
Willans & Robinson	1	Nil	..	—	..	Nil
Do. Pref.	5	Nil	..	—	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent. August 29th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1912.

THE August returns of electrical business, both as regards exports and imports, disclose a satisfactory improvement over the preceding month. The exports reached a total of £530,350, as compared with £419,898 in July; this represents over £460,000 worth of business exclusive of telegraphic material, and includes nearly £180,000 worth of machinery, and cable exports valued at £111,867—which latter amount is probably a record. Telegraphic exports for the month amounted to approximately £69,000, being practically the same as in July, while telephonic exports at about £65,000 were double those of the preceding month.

In the import section, the total of £194,090, compared with £180,702 in the preceding month, and lamp, machinery and telegraphic and telephonic imports were on a more extensive scale than in that month.

The re-exports at £23,741 were almost double those of the previous month.

Of our several customers, New South Wales occupied the premier position with a total of £75,576, this figure being, however, unusually high owing to a large purchase of telephonic material.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,495	76	77	132	...	148	6,392	8,644	666	41	1,747	1,944	21,362
Germany	1,701	2,484	5	18	562	145	1,929	1,442	21	...	75	448	8,830
Netherlands, Java and Dutch Indies ...	739	1,518	107	...	...	3	351	367	7	41	51	769	3,953
Belgium	663	488	105	10	361	29	2,345	698	...	16	403	1,096	6,214
France	715	50	3,421	...	10	52	6,590	103	13	...	114	16,267	27,335
Portugal	28	20	...	18	...	20	176	19	62	...	599	63	1,005
Spain, Canary Isles and Spanish N. Africa...	100	771	862	...	...	797	3,617	640	75	10	68	6,486	13,426
Switzerland, Italy and Austria-Hungary ...	665	...	330	34	43	186	3,199	117	30	903	...	1,197	6,704
Greece, Bulgaria and Turkey	647	128	...	13	...	...	1,029	30	2	...	705	2,557	5,111
Channel Isles, Gibraltar, Malta and Cyprus...	50	30	4	79	...	118	2,162	...	4	...	11	71	2,529
U.S.A. and Philippines	1,379	...	203	140	...	47	616	276	218	...	...	20	2,899
Canada and Newfoundland	1,287	3,870	2,052	1,199	170	4,758	15,956	443	816	...	1,760	2,507	34,848
British West Indies and British Guiana ...	186	...	46	11	...	...	163	11	16	...	49	13	495
Mexico and Central America	901	67	...	...	...	...	874	24	26	...	105	32	2,029
Peru and Uruguay	41	13	269	18	20	...	712	...	...	24	...	99	1,196
Chile	199	59	296	51	13	207	4,829	550	59	28	63	10,396	16,750
Brazil	1,733	1,288	804	282	25	505	5,564	568	85	33	7,592	1,320	19,799
Argentina	2,412	8,693	829	242	30	485	8,185	3,309	4,079	339	3,077	4,655	36,335
Colombia, Venezuela and Ecuador	13	33	15	13	...	...	...	...	8	...	19	4	105
Egypt, North Africa and Persia	109	227	350	28	...	100	600	801	103	...	279	1,647	4,244
British West Africa	10	683	52	13	...	...	236	22	5	...	68	225	1,314
Rhodesia and Transvaal	2,091	410	304	1,284	16	6	5,292	—	173	...	446	211	10,233
Cape of Good Hope	1,475	8,044	706	413	241	523	1,452	431	441	...	71	1,847	15,644
Natal	1,113	2,316	1,148	171	14	16	2,872	140	115	13	24	1,230	9,172
Zanzibar, Brit. E. Africa, Mauritius and Aden	54	10	265	26	...	51	104	...	749	...	6	115	1,380
Madeira and Portuguese Africa	111	268	79	...	...	46	1,007	...	...	...	...	36	1,547
China and Siam	480	2,816	277	41	...	986	936	...	345	14	191	405	6,521
Japan and Korea	252	38,107	267	119	...	1,599	13,849	9,626	3,132	...	49	704	67,704
India	2,862	6,469	2,144	3,464	191	1,238	12,626	9,913	2,228	338	916	774	43,163
Ceylon	307	377	1,113	113	...	...	172	1,394	707	13	40	285	4,511
Straits Settlements and Federated Malay States	210	3,382	349	30	...	184	1,532	131	185	11	3,445	3,110	12,569
Hong Kong	13	242	49	49	...	...	454	701	34	63	17	54	1,676
West Australia	583	859	222	861	205	983	1,539	...	733	6	251	382	6,624
South Australia	45	418	111	546	...	123	998	...	27	...	962	5	3,235
Victoria	3,343	6,744	708	3,022	13	5	3,184	1,314	314	12	5,152	...	23,811
New South Wales	5,167	14,438	693	1,143	104	1,406	17,783	923	112	17	28,891	4,899	75,576
Queensland	439	222	49	389	...	436	2,540	453	108	...	1,819	893	7,348
Tasmania	56	229	208	...	...	...	329	48	...	...	1,010	...	1,880
New Zealand and Fiji Islands	1,723	5,988	756	1,265	...	930	3,353	...	330	...	4,841	2,077	21,263
Total, £	35,397	111,867	19,275	15,237	2,018	16,132	135,547	43,138	16,058	1,922	64,916	68,843	530,350

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	1,405	20	...	15	...	...	2,861	...	514	5	5,384	10,204
Germany	7,157	7,238	2,364	12,281	6,479	275	62,657	2,494	3,319	7,421	19,661	131,346
Holland	6	...	...	192	452	12	680	...	...	20	411	1,773
Belgium	818	1,298	9	183	100	...	1,664	88	444	864	3,274	8,742
France	84	200	725	635	559	1,071	141	980	998	3,661	1,279	10,333
Switzerland	69	1,697	...	19	100	...	1,017	...	...	...	1,312	4,214
Italy	75	615	...	...	...	...	1,158	20	...	...	2,936	4,804
Austria-Hungary	...	1,012	...	486	78	...	68	...	...	192	216	2,052
United States	1,770	20	665	240	846	30	9,828	6,133	66	106	364	20,068
Canada	20	...	...	...	...	...	91	...	75	...	18	204
Total, £	11,404	12,100	3,763	14,051	8,614	1,388	80,165	9,715	5,416	12,269	34,855	193,740

Additional imports: Spain, carbons, £350.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	10,278	810	...	642	237	...	7,480	...	289	427	3,578	23,741

TOTAL EXPORTS: £530,350. TOTAL RE-EXPORTS: £23,741. TOTAL IMPORTS: £194,090

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE USE OF MICA IN THE INSULATION OF ELECTRICAL APPARATUS.

By A. P. M. FLEMING, M.I.E.E., and R. JOHNSON, A.M.I.E.E.

(*Concluded from page* 446.)

Some attempts have been made to use annealed mica for commutator segment insulation, but, as already stated, there is very considerable tendency for this material to disintegrate, and thus far such experiments have not met with success.

With regard to the bushings insulating the commutator from the supporting frame, some manufacturers prefer to use paper instead of mica, partly on the score of cheapness, and partly because an even thickness, and consequently better bearing surface, is more readily obtainable.

Unless a very good fit is effected, so that the commutator remains rigid when running, "high bars," "flats," "high mica," and other troubles will be experienced. Moreover, with very high speeds where the stresses are great, an actual grinding action may take place on the insulating bushings, and these, if of mica, will be readily reduced to powder at the places where the grinding takes effect.

It is, however, only a matter of careful manufacture to make mica bushings as uniform in thickness as paper, and undoubtedly mica insulation possesses great advantages over paper for this work. Even when the commutator never attains a very high temperature, paper rapidly dries to extreme brittleness. Paper, moreover, loses its insulating value when subject to deposits of moisture, such as may occur when the conditions are such as to favour "sweating" of the commutator.

Mica bushings for commutators are moulded from stiff built-up sheet. Thin sheets are used for this purpose, and a considerable number employed to make up the total thickness required. These sheets are softened by heating them in an oven or on a steam plate. They are pressed by hand into the hot mould, the heated core then being inserted and screwed down.

Mica bushings are made in thicknesses from $\frac{1}{32}$ in. to $\frac{3}{32}$ in. according to the size of the commutator for which they are intended. When these bushings have been arranged in position in the commutator, it is the general practice to heat the whole commutator up in order again to soften the insulating cement, and thus allow the various parts to be tightly screwed up, and in this way properly bedded. For this reason a much larger percentage of cement is allowed to remain in the bushings than in the mica for the segment insulation.

4. *Other Applications of Mica.*—In addition to commutator work, mica is extensively used in the insulation of armature windings, especially those for high voltages, and also for moulded work of various kinds, insulating bushings, tubes, washers, &c.

For the insulation of oil-cooled transformers mica is not generally used, since the oil is liable to attack the binding cement.

For bushings and washers the principal value of mica lies in its permanence and heat-resisting nature, and in this connection it is well to remember that the insulating value of such bushings and washers depends mainly on the amount of creepage surface it is possible to provide, this often being entirely out of proportion to the breakdown value of the materials employed.

For mica tubes, particularly when of small diameter, a turn or two of paper both inside and outside should be used as a protection, otherwise there is a tendency for the mica to flake and to be easily damaged. It is still better to make the tubes of paper and mica throughout, this improving their mechanical strength considerably. With this method the insulating value is not seriously reduced, and if the tubes are well made by rolling the material on to mandrels under heavy pressure and heat, they are as fire-resisting as the all-mica tubes.

Specially constructed machines are now used for the manufacture of these tubes. The paper used for backing the mica usually amounts to 40 per cent. to 50 per cent. of the total weight of the finished tube. These tubes can be made circular, and afterwards re-softened by heat and blocked out to rectangular shape for the lining of armature slots, or they can be made directly to the shape required on suitable split steel mandrels.

For low-voltage armature coils, owing to the necessity for keeping the thickness of insulation in the slots down to the minimum possible, it is much more difficult to apply mica satisfactorily than the other kinds of insulation more commonly employed. Except for railway motor work where the temperature conditions are severe, it is very doubtful whether its use is justified. Insulations of prepared paper or cloth have proved perfectly satisfactory for low-voltage work, and are, of course, much cheaper.

For the insulation of low-voltage armature coils, the most satisfactory plan is to build the mica on to a backing of thin tough paper with flexible sticking varnish, and to wrap the sheets thus formed around the slot portions of the coils, holding the wrapping in place with a layer of tape.

A second method is to avoid the use of the paper by moulding hard troughs of mica to fit the slots and to push the coils down into these. There are two disadvantages in this method, the first being that since the troughs are open there is only a very short creepage path from the coils to the teeth of the armature, and the second, that in winding the coils into the troughs it is easy to fracture the insulation at the immediate ends of the slots. A similar method, designed to overcome the first of these weaknesses, is to mould the troughs with lips at the top. These troughs are sprung on to the slot portions of the formed coil, the lips overlapping, and in this way effecting a completely closed insulation. This is bound tightly in place with a layer of tape, and the coil thus insulated is then placed in the slots.

For high-voltage armatures the radial thicknesses of insulation necessary around the slot portions of the coils are sufficient to render it possible to make a sound mechanical job with a mica insulation, and there is no question as to the utility of the material for this class of work.

The mica is used with a backing of either treated cloth or paper, made up with flexible varnish and wrapped on by hand, or made up on a thin paper with shellac varnish and hot ironed on to the coils by machine. Coils insulated in either of these two ways can, of course, only be used in machines with open slots, or in closed slots when one end of the coil is left open so that the coil can be pushed into position, and the open end afterwards jointed up. When the coils are formed directly in the machine by threading the wires singly through the slots, the latter are lined with tubes made up of mica or paper and mica, as referred to earlier.

The most satisfactory insulation is that obtained by ironing the mica directly on to the coils, as in this way a solid thickness of material free from air pockets can be obtained. When applied to coils where the individual turns are separated from one another by mica strips or troughs, and the interspaces between conductors filled solid by impregnating with insulating compound, these coils are rendered best capable of resisting deterioration due to electrochemical action.*

Where severe mechanical stresses may be expected on the end connections of armature coils, as is sometimes the case in turbo-generators, the flexible cloth and mica insulation is preferable, unless the projecting portions of the coils are so heavily clamped as to prevent any movement.

The end connections of armature coils are generally insulated with treated cloth strips or cotton tapings. Some attempts have been made to use a mica tape for this work, such tape consisting of one or two layers of thin mica splittings built up with a flexible varnish on paper or cloth. Such a tape, however, will not stretch, and, therefore, buckles around the corners, the mica slipping or cracking, and its use has met with very little success.

The proportions of mica and paper or cloth in the wrappings used on high-voltage armature coils are usually such as to give about 40 per cent. by weight of mica in the finished insulation. Where very thin paper is used, as much as 70 per cent. of mica is sometimes obtained, but the insulation is usually not so good mechanically.

* See paper on "Chemical Action in High-Voltage Armature Windings," by Fleming and Johnson, read before the Institution of Electrical Engineers, January, 1911.

IMPORTANT CASES IN THE LEGAL YEAR.

[FROM A LEGAL CONTRIBUTOR.]

The legal year which came to an end in July has not produced many cases of great interest to the electrical world. Nevertheless there are a few decisions involving the discussion of various points of a more or less technical character, which it may be as well to recall to the attention of our readers. Some of them have been reported either briefly or at length in these columns, but others have only appeared in law reports which are not very accessible to the "lay" reader.

The liability of a contractor for the negligence of a sub-contractor has frequently to be considered and is by no means easy to determine. The sub-contractor is of course liable for the negligence of his own servants; but the contractor will in some cases also be liable for that negligence. He will not, however, be liable for the collateral negligence of a sub-contractor's servant. In the case of Padbury *v.* Holliday and Greenwood (28, T.L.R. 494) the defendants were employed to erect certain premises, and the contract involved the employment by the defendants of sub-contractors to execute the special work of putting metallic casements into the windows. While one of these casements was being put in, an iron tool was placed by a servant on the window sill; and the casement having been blown to by the wind, the tool fell and struck the plaintiff, who was passing along the street. The tool was not placed on the window sill in the normal course of doing the work which the sub-contractors were employed to do. The plaintiff sued the defendants, claiming damages in respect of his injuries. It was held that the injuries were caused to the plaintiff by the collateral negligence on the part of a workman who was the servant of the sub-contractors and not of the defendants, and that the latter were therefore not liable for the consequence of that negligence.

The law with regard to registration is such that it is by no means easy to say what will and what will not be registered as a design. In a case where a plaintiff alleged that the defendants had copied his design for triple-spoke wheels, Mr. Justice Parker laid down some general principles which will be of use to persons who are seeking to register designs in future. He said that a design to be registerable under the Patents and Designs Act, 1907, must be some conception or suggestion as to shape, configuration, pattern or ornament. It must be capable of being applied to an article in such a way that the article to which it has been applied will show to the eye the particular shape, configuration, pattern or ornament, the conception or suggestion of which constitutes the design. In general, an application for registration must be accompanied by a representation of the design—that is, something in the nature of a drawing or tracing, by means of which the design may be imparted to others. A conception or suggestion as to a mode or principle or construction, though in some sense a design, is not registerable under the Act. Inasmuch, however, as the mode or principle of construction of an article may affect its shape or configuration, the conception of such a mode or principle of construction may well lead to a conception as to the shape or configuration of the completed article, and a conception so arrived at may, if it be sufficiently definite, be registered under the Act.

There have not been many cases relating to trade names and their use, but in those which have been decided certain important principles were laid down. Thus it has been held that an exclusive agent for the sale of distinctive goods cannot maintain an action for damage to his trade by the alleged passing off of other goods in imitation of those dealt in by him.

Another case illustrates the fact that the Court will sometimes intervene to prevent a man making use of his own name if it be proved that he is doing so with a fraudulent object. It appeared that one, Thomas Kingston, who had been for some years in the employment of the plaintiff company, and had become skilled in his business, and obtained a reputation amongst its customers, left that company and took steps along with another person to promote the defendant company to carry on the same kind of business as the plaintiff company. The defendant company having been registered, the plaintiffs sought to restrain them from carrying on business under their registered name. It was held on the facts that the use by the defendants of the name of "Kingston" was likely to mislead or deceive the public into the belief that the defendants were the same company as the plaintiffs, and that as the defendant company did not incorporate the individual right which Thomas Kingston had to carry on business in his own name, and as he did not transfer to them a business and goodwill, but merely authorised the defendants to use his name, such use was not justified and must be restrained (Kingston, Miller & Co., Ltd., *v.* Thomas Kingston & Co., Ltd., 28 T.L.R. 246).

Although there have been many patent cases tried within the year there only appears to be one which involves the decision of any general principle in relation to the compulsory working of patents. It was there laid down that Sec. 27 of the Patents and Designs Act, 1907 (which provides that within certain time limits application may be made for the revocation of the patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside of the United Kingdom), was passed for the benefit of the public, and is not primarily intended to confer benefits on individuals. In considering whether there is a proper case for revocation of a patent under the section, the Comptroller or the Court is bound to look primarily at the interests of the public. The non-application by the owners of a patent for a voluntary or compulsory licence to work the patent was held not to be a sufficient reason for revoking their patent under Sec. 27, where nothing they could have done in the way of working the patent in this country could have been done without exposing them to the risk of proceedings for infringement. (In *re* Taylor's patent (Parker, J.,) 28, T.L.R.)

In the domain of tramway litigation, there is one case to be recorded. We refer to that in which an important principle of rating was laid down. The appellants were the occupiers of, and worked as one connected system, a tramway and a light railway, constructed on certain highways. The tramway and the light railway were as to mode of construction and the materials used therein identical, and the same carriages were used on the tramway and the light railway. It was held that the land occupied by the tramway was used as a railway within the meaning of Sec. II, Sub-Sec. I (B) of the Public Health Act, 1875, and that the appellants were therefore entitled to be rated in respect of it in the proportion of one-fourth part only of its net annual value. Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority (1892) I.Q.B. 357 Overruled (Metropolitan Electric Tramways (Ltd.) *v.* Tottenham Urban District Council, 28 T.L.R, 234).

Another attempt was made during the past year to establish the principle that a municipal authority supplying electricity has the authority to deal in electric fittings. Mr. Justice Eve in the case of the Attorney-General *v.* Mayor, &c., of Sheffield (28 T.L.R. 266), laid it down that under the Electric Lighting Acts and Provisional Orders made thereunder a municipal authority has no power to carry on the trade or business of supplying electric fittings and wires for use by those to whom they supply electrical energy or by others. While a municipal Corporation may have a common law right to carry on such a trade or business, it has no power to use for that purpose funds raised under statutory authority for the purpose of supplying electricity.

Space does not admit of our dealing in this article with the numerous cases which have been decided in the settlement of disputes between master and servant. Mention may, however, be made of a point arising in relation to fidelity guarantees. By a fidelity policy the defendants undertook to reimburse the assured in respect of loss sustained by any act of larceny or embezzlement upon the part of their employé. It was held by Mr. Justice Hamilton that the word "embezzlement" in the policy was to be construed in the same way as it would be construed when used in an indictment (Debenhams, Ltd., *v.* Excess Insurance Co., Ltd., 28 T.L.R 505).

NORTH-EASTERN COUNTIES ELECTRICAL EXHIBITION.

The North-Eastern Counties Electrical Exhibition at Newcastle-on-Tyne concluded its second week on the 21st inst., and has already more than justified its inception, for, during the 13 days it had then been open, more than 80,000 visitors had inspected the display, and the last date named was characterised by the largest attendance, for it was close upon 9,000. The aim of the exhibition, as we have already mentioned, was to bring home to the householder the many uses to which electricity can now be put in the home, and to illustrate at the same time its true economy—its brightness, cleanliness, and, at least in the North of England and other favoured places, its cheapness. This object has been fully achieved; on almost every hand the standholders express their satisfaction with the results of the exhibition, so far as it has gone; inquiries have been reasonably numerous, as have, in several quarters, the sales, while the seed of knowledge of the potentialities of electrical domestic economy has been sown broadcast.

The aim of the promoters was to bring the recent developments of electricity in domestic matters to the cognisance of those householders who already use it for illumination, and to a very large extent that object has been achieved, for this has proved to be the most numerous and most prominent class of visitor making intelligent inquiries as to the adoption of electricity. It is also satisfactory to note that the organising manager and secretary, Mr. W. Peacock, has not had to deal with a single complaint. In leaving generalities it may be mentioned that the Exhibition is—almost needless to say—brilliantly lighted, charming from every prospect, pretty and attractive even to the least learned; it has proved a great attraction as a combination of instruction and pleasure, and each week an excellent military band has lent its own charm.

One of the most interesting, as most recent, of attractions, is the electric geyser or water-heater. This is the invention of Mr. Krabb, of Glasgow, and is exhibited by Mr. Vesey Brown on behalf of the K.P.H. Syndicate. Mr. Krabb uses a resistance of ordinary carbon granulated into small pieces, and packed into a container of porcelain or other material which has a low coefficient of expansion. The resistance is packed to suit the flow of water and temperature desired. In the examples shown here the current varies from 12 to 14½ amperes at 240 volts, and heats 1½ gallons to 120° F. from cold (56° F.) in four to five minutes. The consumption of energy is, therefore, about 1 B. of T. unit to every 5 gallons. Other patterns are made with circulating tanks to contain 20 to 25 gallons for baths, or small quantities suitable for restaurants and the like. With the geysers installed in a house, one cold-water pipe throughout, with a tapping of the heating circuit to the geyser, would be all that was necessary in each bedroom, dressing-room or lavatory. Not only does the geyser heat the water, but it also filters it in a very efficient way. As to the cost, having in remembrance that the Newcastle supply costs but little over ·75d. per unit, and at Sunderland it only costs ·5d. per unit, it is obvious that the district is one in which the invention might well be expected to find favour.

On the adjoining stand is one of the Marconi Wireless Telegraph Co.'s installations, and much prominence has been given to the utility of this means of communication as between ordinary cargo vessels. The ½-kw. pattern is erected in a space which illustrates how little loss of cargo room there is required for the installation of a really useful service calculated to meet all the requirements of the ordinary cargo steamer. The induction coil pattern has also attracted much attention, and in respect of each the firm has had several inquiries. Its adaptation for use on tugboats has formed the subject not only of comment, but inquiry, and the practical-minded visitor has seen great possibilities in its use on tugboats on a coast which has an evil reputation in times of stormy weather. In another regard much attention has been directed to wireless telegraphy, that is for field sets for military and quasi-military purposes.

One phase of the domestic use of electricity to which very much attention has been given is its employment as a means of cooking. The collection of appliances is very complete, and a very varied display is the result. The Ferranti oven, with its two-heat simmering plate, grill and single-heat disks is regarded with much favour; and the disk stoves for boiling, simmering and toasting proved their adaptability. Simplex Conduits, Ltd., of Birmingham, also are exhibiting many forms of cooker, from a simple electric toaster or a kettle, hot-plate or boiling plate, to a large oven. The same firm are drawing attention, with good results, to the Brimsdown "Wirum" lamps, which are packed in a novel carton which enables hundreds to be examined without unpacking and in a very short space of time. Other firms contributing to this excellent display are Messrs. Scholey and Co., Johnson & Phillips, Veritys, &c.

To show the process of electrical cooking, the use of the many appliances ready to hand, and the economy of its use, the Newcastle-upon-Tyne Electric Supply Co. are giving frequent demonstrations which are not only interesting in themselves, but in many cases prove little short of revelations to the visitors.

It has been a source of continual surprise to many visitors to learn how readily electricity can be converted into heat for ordinary heating purposes, but in scores of forms illustrations are being given of this use. Mr. F. T. Hanks, of Newcastle, has the "Bastian" heater, which is manufactured by the London Electrical Trading Co., and this compact form of heater has a special local attraction, as the spiral wires are enclosed in Vitreosil, which is made by the Thermal Syndicate, at Wallsend-on-Tyne. These heaters form but one feature on an attractive stand, which includes electric speed indicators, for giving the speed of the turbines at any part of the vessel, obviating the necessity of signalling to the engine room to ascertain the speed. The display of the colour-matching lamp has also proved attractive, and led to business. The Ferranti disk fire, with its ornate antique copper reflector, was much remarked upon. It is claimed that these can be worked locally for 1½d. per hour.

A very complete exhibit is the working electrical laundry of the Provincial Laundries, Ltd., Newcastle. Here are shown the whole of the processes — except the mere washing and starching—and for each operation electricity is utilised, the drying ready for polishing, the polishing by a rotary machine, the damping along the middle of the collar to prevent the linen breaking, and the shaping of the collar ready for use. Then there are shown various species of electric irons suitable for different classes of laundry work.

In an opposite corner of the hall is another stand which has a great attraction for a certain section—an electrical nursery. The little one's cot is gently rocked, the food is maintained at a suitable heat for use, the place is warmed and lighted, and baby's clothes are warmed, all with the aid of a little electricity. It forms altogether a good commentary upon the manner in which this new agency may enter into the most intimate of domestic relations.

The many modes in which electricity is made portable are illustrated in many ways, a striking exhibit being the Edison Storage Traction Co.'s motor-car (an elegant vehicle, which locally can be run for about ¼d. per mile), and a tradesman's electric "runabout," which latter is to be seen in the streets. The Chloride Electrical Storage Co., Ltd., have had many inquiries in respect of their accumulators, and they show a battery suitable for country house lighting, embodying their well-known rosette positive and box negative with wood separators. There is a large show of Exide and Clifton accumulators, suitable for motor-cars, wireless telegraphy on ships and yacht lighting.

The Float Electric Co. are showing their various types of portable lamps, and the facility with which these can be recharged with the electrolyte has been regarded with much favour.

On the stand of Messrs. E. Bevan & Co., of Newcastle, there is shown one use to which their portable air-blast plant may be put. The exhibit is a brazed overhead trolley wire. It was brazed with the Stellite apparatus and then tested at Armstrong College under a tensile stress, and fractured at 1·86 tons; the brazing never gave way. Before testing, the diameter was ⅝ in. approximately, and under the strain it tapered at the centre to about $\frac{3}{16}$ in. where it broke. The apparatus is designed for producing gas and air blast to be

delivered in an intense flame from a blow pipe burner, and has just been patented.

A good deal of curiosity and interest has been aroused by the Ozonair apparatus shown by Messrs. Robert Bowran and Co., Newcastle. The fresh invigorating air produced is so distinctive that few visitors pass without an inquiry.

Apart from what have been mentioned, which are in the main the more popular features of the Exhibition, there are innumerable stands of interest to those concerned with the use of electricity in works, and in its application to industries generally, but these are all more or less foreign to the primary object of the Exhibition, which is the illustration of the uses of electricity for domestic purposes.

INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

Kabul.—After a series of delays due to various causes, active work is now taking place on the Kabul hydro-electric power scheme. Mr. Jewett, who is in charge for the contractors, Messrs. Osler, Ltd., has received instructions to proceed with all possible despatch, and he has been supplied with 400 Afghan sappers and miners to push on with the head work, dams and channel at Jabal Siraj. Four sub-stations will be built between this point and Kabul City, in which place the larger portion of the transmitted electrical energy will be used for power and lighting.

The new steam plant for H.H. the Amir's palace is already in operation under the charge of Mr. Mallett, who has recently been appointed chief electrical and mechanical engineer to the Durbar. In spite of a good deal of local conservatism, the Amir has had his way, and a new era may be said to be established in Kabul. At present there are four electrical engineers and three mechanical engineers busily occupied in carrying out engineering contracts in different parts of the Amir's kingdom. Bridge-building, road-making, workshop erecting, and electric power construction are all in active operation, and in a few years Kabul promises to be a busy industrial centre. Of late the Amir has taken to motoring; his practical mind soon grasped the fact that a motor-car would bring him into closer personal touch with his distant districts and their rulers, and it is characteristic of the Amir that strong conviction was soon followed by prompt action. Roads had to be made—the engineering section of his army and most of his prisoners were put to work. Rivers had to be crossed—contracts for bridges soon followed.

The contracting firms, both mechanical and electrical, who are at present carrying out this work have served him well and gained his confidence, and he is faithful to them in turn; and as no travellers are allowed into Kabul without his permit, it is extremely difficult for outside firms to procure work there. Catalogues and advertising matter are sent in voluminous quantities, but, owing to one cause or another, these seldom reach the right quarter.

Madras.—The Electric Supply Co. continue to extend their mains, with, of course, a consequent increase of load of both lights and fans. With regard to the latter, local wiring contractors are up against a discouraging problem; for, because of the competition of the electric lighting company itself, they find no market for their fans at present. Recently the supply company advertised locally that they were selling 2,000 Crompton ceiling fans at a "big sacrifice"; in fact, at less than cost price, in order to encourage their use. It is generally an accepted fact that wiring contractors are the unpaid commercial travellers of a supply company, and that the latter are as a rule content with selling electric energy; but things are done differently in Madras. A reason for this method of procedure might be given. The Crompton fan is a good one, and worthy of a better fate than throwing it away at "less than cost price *ex* godown."

Delhi.—The electrical work in the new temporary capital is proceeding rapidly. A large secretariat and numerous bungalows have sprung up with surprising rapidity. A high compliment has been paid to Mr. Pitkeathly, the former Electrical Inspector to the United Provinces, by the Government. For his splendid work at the Durbar he was created a Companion of the Victorian Order, and in further recognition of his great organising ability and his powers of quick despatch, he has been selected to superintend the carrying out of the new temporary Government buildings.

Indian Industries and Power says, in its August impression, that "There is much dissatisfaction among firms in Bombay who supply electrical plant and do electrical work, at the system under which electrical contracts for Government are given. It is a general practice in Government departments to put contracts involving large sums of money out to public tender." For some reason, this practice has not been invariably observed by the Electrical Department of the P.W.D. in Bombay, it being a well-known fact that many large electrical contracts have been privately arranged, and the news that some chosen firm is carrying out a certain contract is the first intimation received by others of the electrical profession, who would only be too willing to tender if invited. It is to be feared that Bombay electrical firms are not the only ones who suffer this unpleasant experience. It may be said to obtain in Calcutta as well; here no fewer than three large Government buildings have been practically handed over to firms without calling for tenders in the usual way. This is a reprehensible practice except under very special conditions, and should be taken notice of by the higher authorities in order that there should be no suspicion of unfair preference.

Calcutta Electric Supply Co.—The new generating station at Cossipore has been supplying energy to the mains for some weeks back, and everything is working admirably. The increased demand for energy for factory purposes, and the necessity of centralising the several smaller power houses, decided the supply company to build and equip an entirely new and modern station, replete with machinery, which is the last word in electric economy. The Hugli side at Cossipore was chosen because land was cheap, plenty of condensing water is available, and a convenient siding for coal was close by. The whole supply for the city and suburbs will come from Cossipore eventually, and the several present power houses will become transformer stations. Several new transforming stations are also being built at suitable distributing centres through the city.

The total B.H.P. will be about 13,000, made up as follows:—Three 3,000-H.P. sets and three smaller units of about 1,000 H.P. each; these machines are of the mixed-pressure turbine type, made by the Oerlikon Co. Current will be generated at 6,000 volts, three-phase, and transformed by means of motor-generators to 225 volts, direct-current, for lights and fans. The condensing plant is by Messrs. W. H. Allen & Co., Bedford. The boilers, five in number, each capable of evaporating 20,000 lb. of water per hour, are by the Stirling Co. Several boilers from the existing power houses are also to be installed when convenient.

The main switchboard is by the B.T.-H. Co., Rugby, as are also the switchboards in the sub-stations.

For the new scheme about 60 miles of Glover's cable has been laid; this brings the total mileage of the underground and overhead cable to about 400 miles in the city and suburbs. The total cost of the scheme is said by a local paper to be about £400,000.

Waste Gas from Oil Wells.—For several years the Pacific Light and Power Co. has used the waste gas on property in the Salt Lake oilfield for pumping, drilling and lighting, but millions of cubic feet have been allowed to escape into the air and be lost. To prevent part of this waste two gas engines, each of 250 H.P., have been installed, and a steam engine, burning gas underneath its boiler, has also been put to the work of producing electric power, the total plant giving 400 KW. A connection has been made to the company's power cable in Los Angeles, and if the small plant proves successful, it will be increased a hundredfold or more. The gas which will be so used is not 1 per cent. of the supply available to this company, and there are scores of other large sources in California.—*Financier.*

HIGH-FREQUENCY DISCHARGES IN HIGH-TENSION TRANSFORMERS.

By A. J. Makower, M.A.

It is a well-known fact that, owing to the capacity of the windings of high-tension transformers, a breakdown of the insulation between the windings and the case is liable to set up high-frequency oscillations of a destructive nature in the transformer. Whilst these facts have been observed, yet it does not appear that any measurements have been made of the oscillatory discharges so produced. The following experiments were carried out with the object of gaining some information about these discharges.

A 2-K.V.A. 40-cycle oil-immersed transformer with a ratio of 100 to 4,000 volts was connected to the supply circuit and a short air-gap connected between one end of the high-tension winding and the case. It was found that continuous sparking was set up across the gap when its length was reduced to about 1 mm., and that the oscillation frequency, measured by a tuning circuit containing a variable capacity, an inductance and a thermo-galvanometer, and loosely coupled to the oscillating circuit, was 4,130,000 cycles a second. The connections are shown in fig. 1, in which W represents

Fig. 1.

the high-tension winding, C the case, and S the spark-gap. The low-tension winding is not shown. G, L and K are the galvanometer, inductance and variable capacity constituting the tuning circuit, which was loosely coupled to the oscillating circuit by means of a few turns of wire. In order to estimate the electrical stresses existing between the different parts of the transformer before the sparking takes place, the following measurements were made :—

The capacities between the various parts of the transformer were measured by charging and discharging through a calibrated ballistic galvanometer. The result of these tests was to show that the capacity measured between the high-tension winding and the case was 5,000 cm. ; that measured between the low-tension winding and the case, 3,150 cm. ; and that measured between the high-tension winding and the case, with the low-tension winding connected to the case, 7,400 cm.

If we call K_1 the capacity of the high-tension winding to the case, K_2 the capacity of the low-tension winding to the case, and K_3 the capacity of the high-tension to the low-tension winding, then we have—

$$K_1 + \frac{K_2 K_3}{K_2 + K_3} = 5{,}000,$$

$$K_2 + \frac{K_1 K_3}{K_1 + K_3} = 3{,}150,$$

$$K_1 + K_3 = 7{,}400,$$

whence we obtain $K_1 = 4{,}080$; $K_2 = 1{,}340$; $K_3 = 3{,}320$ cm.

When the transformer was excited so as to give a secondary voltage of 4,000 volts, it was found by means of an electrostatic voltmeter that the potentials between the free ends of the high-tension winding and the case were 2,250 and 1,790 volts respectively, and that there was practically no voltage between the middle point of the high-tension winding and the case. Thus, before any oscillations are set up the full potential of the transformer is so distributed that a strain of about half the full voltage of the transformer exists between the ends of the high-tension winding and the case ; this same strain would exist along the path formed by the capacity of the high-tension to low-tension windings in series with the capacity of the low-tension winding to the case, and so the strain of 2,000 volts would be distributed between these capacities in the ratio of K_2 to K_3. Thus, the voltage between the high-tension and low-tension windings would be about 570 volts, and that between the low-tension winding and the case about 1,430 volts. It will thus be seen that in extra-high-tension transformers it must be of great importance to provide very good insulation not only between the high-tension windings and the rest of the transformer, but also between the low-tension windings and the rest of the transformer, particularly as the voltages between the different parts of the transformer would be very greatly increased if a breakdown between any two parts were to take place with the consequent setting-up of high-frequency oscillations.

It must not be supposed that the capacities that come into question for the high-frequency currents approach the values given above, as the high-frequency oscillations are not able to penetrate through the whole windings. It is very difficult to determine the values of the capacity and inductance that are concerned with these high-frequency oscillations by the usual method of adding a known capacity or inductance to the oscillating circuit and noting the change of frequency of the oscillations that are set up, because the capacity and inductance of the windings are not able to be considered as being connected in series, owing to the fact that they are distributed throughout the windings. However, in order to obtain an estimate of the magnitudes concerned, the following experiment was made :—

An oscillating circuit was energised by a Poulsen arc, the frequency of the oscillations being kept constant. To this circuit another circuit was loosely coupled containing a thermo-galvanometer, a capacity K and an inductance L. When tuned so as to resonate to the primary circuit, it was found that K = 207 cm. and L = 72,100 cm. The capacity was now removed and replaced by the capacity of the transformer by making connections to the case and to one end of the high-tension winding. It was now found to be necessary to insert a total inductance of 547,000 cm. in the secondary circuit to retune it to the primary.

Assuming that the capacity in the tuning circuit was that of the high-tension winding of the transformer to case, and that the inductance of that circuit was mainly contained in the capacity L, external to the transformer, we find that the high-frequency value of the capacity of the transformer winding is—

$$\frac{72{,}100 \times 207}{547{,}000} = 27{\cdot}3 \text{ cm.}$$

From this experiment we may assume that the capacities that come into question for the high-frequency currents are only of the order of a hundredth part of the values measured by the ballistic galvanometer.

Oscillations of the same frequency but of greater power than those obtained by the connections as shown in fig. 1 were obtained by the connections shown in fig. 2, which shows two transformers similar to the one previously tested connected with their low-tension windings in parallel on the

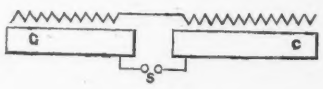

Fig. 2.

mains and the high-tension windings interconnected at one point, the connection between the high-tension windings being such that the voltage between the free ends of the two high-tension windings was the sum, and not the difference, of the voltages of the two windings. It was then found that sparks of more than a millimetre length could be taken off between the cases of the two transformers.

Fig. 3 gives a resonance curve for the oscillations set up in the windings of the two transformers, the deflections of the thermo-galvanometer in the tuning circuit being plotted vertically and the natural frequency of the tuning circuit for various adjustments of its capacity being plotted horizontally. Applying the formula of Bjerknes to this curve we obtain for the decrement per whole period of the oscillation in the transformers the value of 0·24, after allowing a value of 0·04 for the decrement of the tuning circuit.

Thus the oscillations set up in the transformer windings are only slightly damped. They are remarkably steady, and on this account very useful for experimental work on high frequency.

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Oscillatory discharges of the same frequency as in the above cases were obtained when the connection between the high-tension windings of the transformers was reversed, as shown in fig. 4, and the spark-gap removed to the position

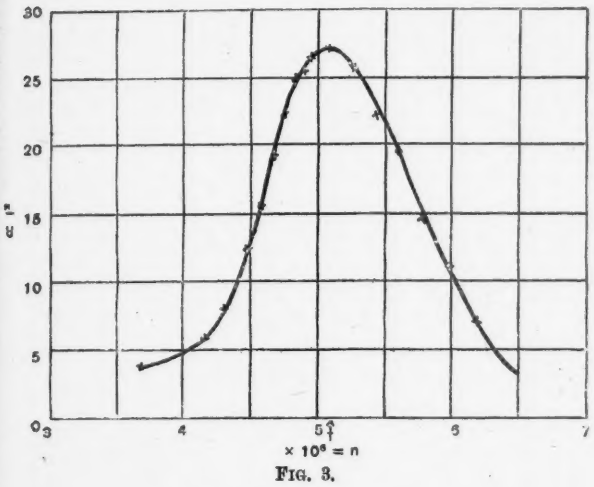

FIG. 3.

as shown, between the cases and the junction point of the high-tension windings.

The oscillations produced in a 40,000-volt oil-immersed transformer of a capacity of 10 K.V.A. were investigated by the methods described above, using the connections of fig. 1, and violent sparks of over 4 centimetres length were observed to pass between the high-tension winding and the case. The

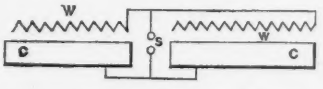

FIG. 4.

frequency of the oscillations was much higher, being 17,500,000 cycles a second, and the logarithmic decrement per whole period was found to be 0·48.

The above experiments show that if high-tension transformers are not designed with very good insulation between the windings, and between the windings and the case, brush discharges may easily be set up, which may cause breakdowns to take place in the high-tension or even in the low-tension windings.

DETERIORATION OF STORED COAL.

THAT coal deteriorates very seriously when stored has long been an article of faith, but lately there has been a considerable disbelief in this waste. It is certainly true that Welsh coal put aboard, say, at Port Said, has a very inferior appearance at times. But there are not wanting those who suggest that there is a special reason why a thousand tons of coal "put aboard" at some foreign coaling station gives so poor a performance in ship mileage. Possibly this old bogey of weathering of coal has been raised to account for mileage not run by coal which isn't there.

To add to this growing doubt of deterioration comes now a paper by the U.S.A. Bureau of Mines, on the subject of weathering, and a fuller bulletin is promised. Many industrial undertakings keep in store from 50,000 to 500,000 tons of coal for long periods, and the Bureau of Mines has often been asked for information on deterioration and spontaneous firing of coal in store. Meanwhile this paper comes as an advance guard. Various quotations are cited as to loss of calorific value, notably Groves and Thorpe, on "Chemical Technology of Fuels," 1889 edition: "In some places coal is known to lose 50 per cent. of its heating value in six months." But such exaggerated ideas are not now common.

Of certain coals tested it is stated that though several evolved large volumes of methane, especially soon after mining, the tested coals lost in one year only 0·16 per cent. of their calorific value from volatile gas escape. Reference is made to an English dock superintendent, who has claimed that sea-immersed coal is actually better for 10 years' submergence by 1·8 per cent., and added that a strong dose of salt water 12 hours before using coal would improve its calorific value considerably.

The Bureau chose four kinds of coal for experimentation, viz., New River, W. Va., a navy coal; Pocahontas, Va., a steam and coking coal, much used on the Panama Canal works; Pittsburg, a coking and gas coal; and Sheridan, Wyo., a sort of black lignite used in the West.

The New River coal was submerged in wooden boxes in 50-lb. samples crushed to ¼-in. size, at three navy yards under different climatic conditions. Samples of 300 lb. of the same lot were exposed in the open air both indoors and outdoors at the same three navy yards.

The Pocahontas coal was exposed at Panama in a pile of 120 tons, and the Pittsburg coal, as run of mine, in 5-ton bins out of doors at Ann Arbor, Mich., and in 300-lb. barrels in fresh water. The lignite was stored at Sheridan, as both slack and run of mine in 3-ton and 6-ton bins. Except the pile at Panama and the 300-lb. open-air piles at the navy yards, sampling was done by re-handling all the coal in a lot.

At Panama a 10-ton vertical sample was removed each time, and from the 300-lb. piles small portions were taken from numerous points in each pile. No tests were made of increase of friability or of slacking. The salt water samples lost respectively 0·3, 0·4 and 0·0 per cent. The fresh-water sample lost nothing. Period of immersion two years.

Coal of ¼ in. exposed indoors lost 0·39 and 0·80 per cent. Other losses varied from 0·11 to 1·85; the last figure was for outdoor exposure at Key West, Fla., uncovered. Climate clearly has an effect. The big pile at Panama lost only 0·3 per cent. in a year.

The Sheridan coal lost from 3·19 to 5·26 per cent., and bins 15 ft. deep lost half as much again as 5-ft. bins. The period of this loss was 2¾ years.

Thus only the lignite coal suffered over 2 per cent. of loss.

Water submergence, salt or fresh, is evidently a full preservative. The lumps of run of mine coal did not slack. Crushed samples deteriorated more than run of mine. The gas coal lost next to nothing by a year's outdoor exposure, even when sampled from the upper 6 in. of the bins.

It is doubtful if the value of submergence is worth the resulting loss due to wetness, but water storage effectually secures coal from spontaneous firing, a point rather supererogatory, by the way, to mention.

As with experiments we have not long ago referred to, it was found that losses from heating by oxidation were worst at high temperatures. Oxidation is thought to be due to absorption by unsaturated compounds, and coals already high in combined oxygen were the biggest absorbers of that gas.

Small heaps of coal soon dissipated any heat, but heat accumulates in densely-packed large piles.

At 100° C. oxidation proceeds more rapidly than dissipation, and with air supply there is soon a fire. The conclusion is that spontaneous combustion is the result of slow oxidation, with sufficient air to support the action but insufficient to carry off the heat. Oxidation depends on surface, and dust mixed with lump is the worst form for oxidation, for it permits air to gain access to the large surface of the dust. Thus the friability of coal is a factor in spontaneous combustion, for it promotes dust.

High volatile contents does not in itself add to the liability to spontaneous heating, and inquiries showed that the "smokeless" coals were as liable to it as the more bituminous.

Curiously enough, coals with much oxygen in their composition are greedy for more, and show a marked tendency to spontaneous combustion. Neither sulphur nor moisture can be regarded as promoters of self-heating.

Freshly mined coal and fresh surfaces are most prone to oxidise, and after a time surfaces become seasoned, so that if a coal has once heated and it is re-handled and cooled it seldom again develops heat. The application of heat naturally favours combustion, and it is easy to understand that bunkers of iron above hot boilers will fire somewhat readily.

The general conclusions are that coal should not be piled over 12 ft. deep, or so that any part is more than 10 ft. from an air-cooled surface; that if possible only screened lump should be stored; that dust should be kept out and handling minimised; that fine and lumps should be evenly distributed; that the store should be rehandled and screened after two months (presumably only one such move is meant); that external sources of heat be avoided; that coal be seasoned six weeks before storing, and should not be dry and wet alternately, and air should not be able to enter a pile through openings round foreign objects such as timbers or brickwork, or porous bottom or coarse cinders.

Pipes for ventilating a coal pile often do more harm than good.

From all that has been published of late, if coal does seem so very bad after weathering, it is due to slacking, a result of friability, which will, of course, make it more difficult to burn. It is very true, however, that weathered coal has a shockingly bad appearance, but then it is by no means the case that the bright bituminous coals raise more steam than some of the dull coals. Meantime, there appears to be little or nothing from marine engineers, who ought to know how much of fault should be debited to the weathering, and how much to causes only hinted at with trepidation.

Bristol Electric Lighting.—A L.G.B. inquiry was held on September 19th into the application of the T.C. for a loan of £6,646 for electricity purposes, including £3,785 for a motor-converter, and £947 already expended on mains. There was no opposition.